

# SUPPLEMENT.

## The Mining Journal, RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

No. 1801.—VOL. XL.

LONDON, SATURDAY, FEBRUARY 26, 1870.

{STAMPED .. SIXPENCE.  
UNSTAMPED FIVEPENCE.

### Original Correspondence.

#### EMIGRATION.

Much has been, and will be, said and written upon this vexatious question, Emigration, and something, too, has already been accomplished, but that something is little indeed when contrasted with the dire necessities of the case. Whatever the causes may be which make emigration a vexed question, however people may differ as to the mode in which it is to be treated, it is a generally admitted fact that emigration on a large scale is becoming every day a matter of imperative necessity. There are some, indeed, who are still of opinion that England can ill spare any portion of her muscle and sinew to waste its sweetness on the desert air of the Australian or Canadian colonies, but we would ask such to visit the East end of London at the present time, or to stroll at any hour of the day through some of our suburban settlements, more particularly those bordering upon the valley of the Thames, in the neighbourhood of Stratford, Barking, and Woolwich, and they will see there, in the groups of what were once stalwart young men huddled together at the corners of the streets, and too often in the vicinity of the beershops, the effects of enforced idleness. Not only has the physique of the labouring man suffered severely, so that "the muscle and sinew," which the country could ill afford to spare, is altogether gone, but the moral deterioration is more serious and more lamentable still. Those who in days of comparative prosperity occupied the homes of smiling industry, with all the surroundings which make life dear and pleasant, are now compelled to look back upon the past, not with the tender regret with which one recalls the memory of what once was sweet, and which in the course of nature has passed away, but with feelings of resentment, bitterness, and animosity, arguing that had matters been otherwise managed—managed as they might have been—wives and children need not starve, and work would have been procurable by those who were willing to work. The air of contentment with his lot, pride in his country, and cheerful submission to the authority of his superiors, which at one time characterised the British workman, is too often now-a-days exchanged for the scowl of discontent, and the half admitted thought that any course is justifiable which might restore to him and his family some few of the comforts which, owing to hard times, they have lost. If the thousands out of employ are not to be plunged into a yet lower depth of want and misery, if the poor rates are not to be increased beyond all endurance, and if, as a necessary consequence of this state of things, crime is not to be allowed to gain head in our large towns, and more especially in this great city, some plan must speedily be adopted by which remunerative employment may be found for the thousands who are footsore and way-worn with seeking work, and finding none, while in the meantime their families are starving. Great care is needed in handling this important subject, and great mistakes are made. Universal benevolence, or in other words ill-considered charity, does but little good. Still surely it is better to send "flannel waistcoats and moral pocket handkerchiefs" for the use of the negroes in the heart of Africa, or warming pans and skates for the comfort and entertainment of the natives of India, than to sit still and do nothing. Until some other plan is hit upon, the only outlet for our surplus population which presents itself, is emigration. It is argued that there are thousands of acres of reclaimable land in the United Kingdom which might be brought under cultivation. We do not deny it, but all we know about the matter is that thousands of labouring men fail to find employment upon the land already under cultivation, and while the reclamation scheme is maturing they are starving. On the other hand, our colonies are glad to receive able-bodied, hard-working, respectable men with their families. We complain of the difficulty of finding a market for our home manufactures. The more we aid in colonisation the greater will be the facility with which we shall dispose of our goods. With increased prosperity abroad, these new colonists will come into our markets for the supply of their requirements, and as those requirements increase, the frugal and prosperous colonist is able to send over to the old country for his friends to join him in the successful cultivation of the soil, or in the management of his stock. Thus not only is present relief obtained, but a perpetual drain of the surplus population is kept up, to the benefit alike of the colony and the mother country, while at the same time pauperism being lessened, the poor rates decreased, the burthen at home is lightened, and competency, if not affluence, secured by immigrants abroad. So far, then, most people are agreed with regard to the boon which a well-organised system of emigration would confer, but a great diversity of opinion obtains as to the best mode of conducting emigration on a scale sufficiently large to secure the desired relief. A letter, signed by Mr. WM. FRESTON, appeared in a contemporary a few days ago, which throws out the following useful suggestions:—

- 1.—That the Government should introduce a Bill authorising the guardians of any parish in which distress arising from a surplus of unemployed labour is proved to exist to the satisfaction of the Poor Law Board, and which cannot be provided for without increasing the poor rates of the year above 5s. in 12, to borrow money of the Public Works Loan Commissioners on the security of the rates, repayable by instalments, for the purposes of emigration and migration of the unemployed.
- 2.—That the guardians be further authorised to assist families to remove from their districts to other places where labour is required.
- 3.—That the rule forbidding the guardians to assist the wife and family of any artisan who has gone abroad, leaving them chargeable, should be relaxed in favour of such as have settled in British colonies, in which case the guardians should have power to advance half the passage money to send them out.
- 4.—That the board of guardians of every large town should be required to provide a farm of sufficient extent, and have power given them to employ thereon such able-bodied paupers as they may think fit. The men not to be permitted to leave without giving a week's notice. In the event of their leaving without notice, or neglecting or refusing to work—punishment; House of Correction for seven days, with hard labour, by the justice of peace on conviction.
- 5.—Any person applying for relief for three successive nights at any casual ward to be taken before a magistrate, who should have power to send him to the farm for the term of 14 days' labour, unless he can show some reasonable expectation of obtaining a livelihood.
- 6.—Returns to be sent weekly to a department to be formed under the Poor Law Board in London, with full particulars of the ordinary

trade or occupation, capabilities, and family of every able-bodied man receiving relief, and of such as may be employed on the farm before mentioned, such lists to be open to public inspection from ten till four daily, and information to be supplied gratis to every employer who may require labourers, and who may write about the same, and also to the agents of the colonies.

7.—The relieving officer of any district in which it shall be proved by coroner's inquisition that a person who has applied for relief has died of starvation to be prosecuted by Government; and every guardian of such district to be liable to be dismissed from office by order of the Poor Law Board, and fresh guardians to be elected by the ratepayers in lieu of those dismissed.

8.—The circular now issued by the Emigration Commissioners, Park-street, Westminster, to be published monthly, and distributed gratuitously at every post office in the United Kingdom.

9.—The passage money provided by guardians of the poor for any emigrants to be paid to the Commissioners of Emigration, who shall superintend the shipment of such persons.

We trust that this most important subject will be taken up energetically by our legislators, and that prompt and effectual legislation will ere long mitigate the terrible distress existing around us.

#### THE PRESENT AND FUTURE VALUE OF THE COLONIES TO GREAT BRITAIN.

SIR.—The value of the colonies to the mother country must be an apparent fact to everyone who considers this important subject, not only as the recipients of the surplus population of this country, but also for the vast returns they make in raw materials for home manufacture and re-exportation. Not the least important is the vast amount of bullion which is continually flowing into the mother country, in payment for exports or investment.

It is a most remarkable fact in the history of the present generation that the precious metals should have been progressively discovered to exist in such abundance in so many British dependencies. Although the man who first made the discovery of gold in Australia in 1829, was considered by his friends to be demented, yet it proved some years after to be the fact that the precious metal existed through the whole range of that country, from Adelaide through the whole of that vast island to the northern part of the Queensland settlement. Then followed the development that New Zealand was also richly auriferous, nor at this moment is the value of this fact known in the colony itself, and much less by the people at home. There can be little question but that the whole group is the nursery of millions upon millions of treasure, distributed through the yet unexplored interior, accessible by the rivers, both on the east and west coasts. The English public has not yet realised the fact that New Zealand has in it wealth to enrich many thousands of our countrymen.

Then, we find that the auriferous Australian belt, that was supposed to have stopped short at Baxes Straits, is now found to have passed that barrier, and is traceable through Tasmania, probably from the Straits to Storm Bay, which will give forth additional treasure to the British emigrant, and add more riches to the mother country. It may be a fair proposition that the precious metals may be found in Australia in the vast yet unexplored country west of the present developments. The above are the known treasures existing in the British colonies in the southern hemisphere, but there are treasures of a vaster extent, and which will prove more productive, in her dominions, in the northern hemisphere.

The existence of silver and copper in the northern portion of Lake Superior, which is not yet worked, has been known for many years, but further west than the Red River settlements extends that vast fertile belt of luxuriant country that is capable of producing enough food to feed a population equal to that of Great Britain; and west of this are the magnificent range of the Stony or Rocky Mountains, at the foot of which are beds of coal in veins of from 12 to 18 feet in thickness, also petroleum springs, literally saturating the ground for some distance around their points of issue, and ascending these steep gold and silver ores present themselves at two different altitudes, above which rich silver-lead is procurable in any quantities. But these riches are incomparably small to the vast wealth that will be found on the western side of these mountains above the present Caraboo diggings, where the Sierra Nevada range of mountains intersect and conjoin the Stony range. This will be found to be the richest deposit of the precious metals of any in Her Majesty's dominions, and will quite eclipse any discovery yet made. It may appear to some presumptuous to make so broad an assertion, but if this does not prove to be the case, Nature will falsify herself. In proof of this fact, the largest flake of gold that has ever been found is procurable on the bars of the Upper Fraser River, these have been disintegrated from the mountains above, and rest on the present sand bars.

It may be asked why the diggers who have tried the "placer" workings at Caraboo have not done better at their work than it is reported that they have. Simply from the fact that they had to buy all their supplies from Jews, who monopolised all the trade, and who charged these miners most extortionate prices for most inferior goods, and thereby have ruined their own trade. These fellows, who have sucked the life blood of the miners, are the men who are calling so loudly for the annexation of British Columbia to the United States, in order that they may have a fresh set of men, from whom they may draw more blood.

Whoever lives to see another twenty years (for it takes that time to convince an Englishman of such a fact) will find that this portion of the British dominions will be producing gold in larger quantities than any of the other colonies under the British flag, or than any other present known gold-producing country.

Be it remembered that although the climate of this part of the world is cold in winter, and precludes the possibility of working the diggings for many months in the year, it would not prevent mining works from being carried on through the whole year, as the exposure of gold ores to a winter's frost tends to facilitate their reduction. It will be found that Great Britain possesses colonies in both hemispheres that can compete with any of the gold-producing countries in the world, yielding their riches to any extent that may be required.

Thus the British colonies are the great backbone of our commerce, producing raw material sent home for manufacture, employing home artisans, those manufactures are returned in British ships to the colonist in varied goods required by them, and the payment for

which is made in remittances of the precious metals extracted from the metalliferous rocks of those colonies, thereby enriching all those who are engaged in this worthy development of the bountiful wealth with which a kind Providence has blessed our industrious country. — AN OLD GOLD MINER.

#### COAL BETWEEN THE SOUTH STAFFORDSHIRE AND SHROPSHIRE FIELDS.

SIR.—In the Supplement to last week's Journal your correspondent, "Colliery Engineer," writing under the head of "Prevention of Colliery Accidents," says—

"I believe there is a vast tract of coal existing between the western boundary fault of the South Staffordshire field and the Shropshire field. It is generally believed that in past times these fields were united, and the parting is attributed by some to convulsions, and by others to denudation; and there is every proof of the latter being the correct view, for on the Shropshire side they have driven through the fault, and found coal at some distance from the main field."

Now, Sir, the above observations seem to me to convey the very erroneous impression that the valley of denudation has been driven through, and coal found on the other side of the valley. I will, therefore, feel obliged if your correspondent will enlighten me and your many readers as to where the operations he alludes to have been carried on? If he refers to the Granville, Stafford, or Kemberton pits, I think he will find that at neither of these pits has coal been found at some distance from the main field, but in connection with the Shropshire main field. In fact, all the coals found in the pits alluded to are on the western side of the denudation or Great Symon Fault, as it is locally called.

My object is not to enter into a controversy on the subject, but merely to guard against such an error as "Colliery Engineer's" observations tend to convey; and, in conclusion, I would refer him to my letters on the "Discovery of Coal in Shropshire," in the *Mining Journal* of Oct. 27, 1866, and on the "New Shropshire Coal Field," in the *Journal* of Nov. 24, 1866. MARCUS W. T. SCOTT, 4, Westminster-chambers, Victoria-street, S.W., Feb. 23.

#### IRON WORKS IN SHROPSHIRE.

SIR.—The Lilleshall Iron and Coal Company possess five blast-furnaces at the Lodge and four blast-furnaces at Prior's Lee. Coal is raised at their pits to the extent of over 1500 tons per day, and of ironstone about 400 tons per day. About one-half of the coal is sold, and the ironstone is used solely at their blast-furnaces. There are four blast-furnaces in operation at the Lodge (which were first established in 1827); these have recently been raised from 50 feet to 71 ft. in height, one more is in course of being raised to the same level. They are all brick-built, and hooped with iron. Their diameter at the bosh varies from 14 to 16 ft., 5½ ft. in the hearth, and 9 ft. at the top. The four completed furnaces are all blown with cold-blast; the average produce of pig-iron from each is 131 tons per week. Previous to the alteration in their height, 66 cwt. of coal was required to smelt 1 ton of iron; this is now reduced to 53½ cwt. of coal per ton of pig-iron, the saving is due principally to the increased height. The coal is calculated to produce 50 per cent. of coke; the admixture of shale in the slack—which is separated by washing—is included in the calculation, so that the proportion of pure coke to the ton of iron produced would be about 25 cwt. The native argillaceous ironstones are used solely in the blast-furnaces, and comprise Pennystone, black stone, blue flats, yellowstone, chance Pennystone, ballstone, white flats, and the brick measure. A mixture of all these with pure coke, and smelted with cold-blast, produces the excellent pig-iron for which these works are noted. Three calcining kilns have lately been erected at the back of the furnaces, 40 ft. high, 26 ft. diameter, cased with iron plates outside, which will effect a saving of fuel and greater regularity in the process of calcining, as compared with the method of open clamps. The kilns, as well as the coking-ovens and open hearths, are situated on the old level; the materials are raised 21 feet to the top of the furnaces, by two vertical pneumatic lifts, one carriage to each lift; the blast to give motion to them is supplied by the blast-engine. The raw ironstone is raised to the top of the kilns, up an incline, by a small steam-engine. There are 50 coke-ovens erected at the back of the kilns, 11 feet round. The ovens have flues at the bottom and sides, and there is one short chimney to every four ovens. They are said to work with less waste than the ordinary ovens. A coal-washing machine is in operation, which cleanses all the slack used in the ovens. The coke is drawn out by hand, and as it is withdrawn is watered by perforated pipes placed over the doors. About one-half of the coke is produced in the ovens, and the other half is got by coking large coal in open hearths; the result is about equal in quality and yield to that coked in ovens. The Clod coal is best adapted for making iron, then the Top coal, and the Randle coal ranks third in quality. The mountain limestone from North Wales is used as a flux. There are two blast-engines working together in one house, of the elongated beam construction; the steam cylinders are 40 inches, the blowing cylinders 86 inches diameter, placed at the opposite ends of each beam; 84-ft. stroke; pressure of steam, 35 lbs. in boilers. The steam is used expansively, being cut off at one-fourth of the stroke, and condensed. The valves are worked by bevel-wheels and cam-gearing on an improved principle. One fly-wheel is actuated by a connecting-rod from the end of each beam; pressure of blast, 3½ lbs. This pair of engines was built in 1862, at the Lilleshall Company's works, and eight pairs of blast-engines of this construction have been made at the works and sent to various parts of England and Scotland. There are six boilers, double-tubed, connected with the blast-engines, for these slack is used for firing. The ordinary rate of going of the Lodge engines is 16 strokes per minute, but they can go 20 or more strokes per minute.

Prior's Lee Blast-Furnaces.—The four furnaces here were erected in 1850: they are round, on brick pillars, hooped with iron; they are 50 ft. high, 15 ft. at the bosh, 6 ft. in the hearth, and 10 ft. in diameter at the top. Three of the furnaces smelt with hot-blast and one with cold-blast. One of the furnaces is out of blast temporarily, undergoing repairs. The same ores are used in all—that is, the native ironstones and Lancashire hematite. In the cold-blast furnace, coke made in open fires is used; the produce is 135 tons per week. There are three tuyeres to this; these are dry tuyeres, laid on a plate at the bottom. The same form and number of tuyeres are in use at the Lodge furnaces. The produce of pig-iron at the Prior's Lee hot-air furnaces is 220 tons per week each; in these 30 per cent. of raw coal is used, which is the Clod and Randle variety, the other 70 per cent. is coke made in ovens and on open hearths. There are 42 coke-ovens built here, 11 feet round, and fired beneath, utilising



the washed slack. One large stack carries off the gases and smoke from the whole of the ovens: 39 cwt. of coal is required to make 1 ton of hot-blast iron. There are two hot-blast stoves to each furnace, or six altogether. Each stove contains 42 double pipes. A double pipe is 12 feet long, 10 by 3 inches inside, divided in two by a partition 1 in. thick. The blast is 800° temperature at the tuyeres. The pressure of blast is 3½ lbs. The stoves are heated with small coal. At one of the hot-blast furnaces the gas is taken off by the Darby bell. The bell is 4 feet wide at the neck and 5½ feet at the bottom, and dips 6 feet into the furnace. The gas thus taken off is used in raising steam in the blast-engine boilers. There are a pair of blast-engines working together in one house, of the elongated beam construction. The steam cylinders are 36 in., and the blowing cylinders 76 in. diameter, at opposite ends; 8-ft. stroke; steam pressure, 45 lbs. in the boilers, is cut off at one-fourth of the stroke, used expansively, and afterwards condensed. There are seven boilers, two tubed, for this pair of engines, all heated with the waste gas. There is one high chimney for these boilers, and another for the stoves. There are five tuyeres to each hot-blast furnace—that is, two at sides and one at the back; these are hollow wrought-iron water tuyeres. One vertical lift raises materials—ironstone, fuel, and limestone—from the bottom to the top of the furnaces. There are two carriages, ascending and descending together; the engine, with drums for working them, is placed between. Each carriage is attached by two three-linked chains to the drums.

The Lilleshall Company contemplate utilising the furnace waste gas at the Lodge for the boilers, and extending the system at Prior's Lee for heating the stoves. The whole of the works are under the direction of Mr. T. E. Horton, the managing partner.

Feb. 22.

MINING ENGINEER.

## THE MINING DISTRICTS OF SHROPSHIRE—No. I.

SIR,—As a prelude to a description of a rich mineral district, which is just now attracting considerable attention, it may be well to state that I am not at all interested in mining, that I have no object to serve beyond giving my impressions of what I saw and heard, and of hitting off one or two topographical, geological, mineralogical, and other features which struck me during a pleasant ramble. Hearing that two or three London gentlemen, who have just taken a considerable slice of mining ground, were coming down to meet the lord of the manor of Shelve and Linley, to go over a portion of the property, I gladly accepted an invitation to join them, as a representative of the *Mining Journal* in this district.

Singularly enough, we met with a second party, also going in the same direction, and upon the hill a third, who had come down with a similar object from Liverpool—to go over the ground, such is the attraction the Shelve district now holds out to those interested in mines. The day chosen was Friday last, a bitter cold day, and one which appeared to grow colder as we ascended the hills, where the snow yet lay in deep drifts, and where sheets of treacherous ice lay in wait for the unwary. It was by no means surprising that novices like Londoners should go down, but it created a little amusement to find a Cornish wrestler, like Capt. —, who is remarkably strong upon his pins, and a tough muscular teetotaler, sprawling upon his back, he (the said captain), too, having previously formally settled it in his own mind that he could not possibly fall as others did.

It was certainly a top-coat colder on the hills, which we ascended after a remarkably pretty drive from Minsterley up to the Grit, or Roman mines. There seems to be no doubt at all but that the Romans did work these mines. The old openings are still visible on the sides of the hill, and are not only smaller than modern drifts, but, being more circuitous, they appear to have been made when in the absence of the present means of mining it was necessary to work round knots of hard rock, such as now would be either cut through or blasted. Indeed, there seems every reason to believe that Shelve was the scene of mining operations carried on by that enterprising people, and that several rich veins cropped out here at the surface, which they followed into the hill sides as deep as they could follow them with their then inferior means of mining. Among other evidences of the antiquity of these excavations, it may be mentioned that shovels made of oak, rounded at the end, with a very small knob at the opposite end, and a slanting hole a few inches in advance, as if intended for a handle, have been found in the galleries, three or four of which were shown to us by Mr. Whittall, Mr. More's mining agent, who also showed us a Roman pig of lead, probably made from the produce of this very mine, and which bears the impress in clear Roman characters IMP. HADRIAN. AUG. Just below these old mines modern works are in operation, pumping out the water and getting out the ore.

Instances of early disturbances are evident at the foot of the hills, and here a hard crystalline greenstone rises in bosses, and is seen on the side of the hill in small pieces, whilst higher up, above the Roman mines, volcanic grits are found, embedded in a matrix of trap. Evidences, indeed, of long-continued igneous action, both during and subsequent to the formation of these rocks, are numerous and distinct enough to account for the rich metalliferous veins which traverse this wild looking district in so many directions.

The whole of this elevated tract of ground appears to constitute one great bunch of lead lines, running from certain great centres of volcanic action, crossing each other either in direct or deflected lines, with a productive result scarcely equalled elsewhere in the kingdom. I purpose addressing you further on this subject next week.

Madeley, Salop, Feb. 21.

J. RANDALL.

## EXPLOSIONS OF SAFETY-LAMPS.

SIR,—Although most explosions of fire-damp in collieries are accounted for by bringing forward at least a plausible theory, there are some which appear perfectly inexplicable, unless the probability of the explosion of an apparently uninjured safety-lamp be admitted. In this connection, then, the notes of Mr. A. Mezger, M.E., published in the *New York Engineering and Mining Journal*, are particularly interesting. He states that an incident showing the liability of a safety-lamp to explode occurred at Zwickau, in Saxony, where a lecturer had been explaining the principle of the safety-lamp to a considerable audience, and proposed to illustrate his remarks with an experiment. For this purpose he had prepared a simple apparatus, consisting of a large glass jar, and a rubber pipe with a glass elbow at one end. The other end of the pipe was connected with a gas fixture; a safety-lamp was set inside the jar, and the bent glass nozzle was introduced to the bottom of the lamp. The lecturer remarked, that, upon turning on the gas, an explosive mixture of carburetted hydrogen and common air would be formed in the jar; the flame of the lamp would be elongated, and a long blue tip would be seen; then the whole interior of the wire gauze cylinder would be filled with flame; but, though the gauze might become red hot, the flame could not in any case strike through to the outside—all of which phenomena, positive and negative, would be clearly visible through the transparent jar. The gas-cock was thereupon opened; but instead of the peaceful demonstration looked for, a prompt contradiction of the theory was the result. The flame was communicated almost instantly to the gas outside of the lamp. In some confusion the lecturer repeated the experiment, but with the same result; and he finally gave it up, confessing his inability to explain the disappointment, except on the hypothesis of some unknown imperfection in the lamp.

The Zwickau lamp may have been unusually faulty in construction rather than principle; but this fact, though it might lessen the importance of these special experiments, could not alter the general bearing of both practice and theory on the question of the safety of all lamps. The principle involved is that of the rapid conduction and radiation of heat by the wire of the gauze surrounding the flame. Before the burning gas can pass through the meshes, it is said, so much of its heat will have been abstracted, and radiated away in all directions, that it will fall below the temperature of ignition or explosion. Now, this depends on the amount of heat communicated to the wire in a given time. The wire may get hot faster than it can grow cool again; and if this increase of temperature is carried to a white heat, the gas outside will be set on fire. But the amount of heat given to the wire in a certain time depends, again, on the amount of burning gas that passes through it in that time; and hence it is clear that a strong current of gas may overheat the wire, and cause an explosion. The Davy lamp is not constructed to favour a strong current. Indeed, one complaint of it has been the feebleness of the

light, from insufficient air. It appears, however, that attempts to remedy this deficiency are fraught with peril.

B. W. R.

## IS COPPER TOO LOW?

SIR,—Your correspondent, "Investigator," (whose letter appears in the Supplement to last week's *Journal*) assumes that copper is unduly depreciated, in consequence chiefly of a revolution in the mode of working the trade. But may it not be quite as plausibly argued that copper is gradually finding its level, in consequence of the removal, one by one, of artificial props?

The history of the trade for several years past seems to prove the vanity of fixing a limit of price below which production must fall off. Four years ago a firm of great authority in copper asserted that at 15s. per unit "at least one-half of the mines in Chili cannot exist, whilst others must of necessity produce much less, as only the rich ore, and ore from mines exceptionally well placed, would pay cost at such a price." Last year the export from Chili was the largest ever known, in spite of prices averaging nearer 13s. than 15s., and a practical smelter has lately returned to Chili, staking his reputation, and a good deal of money besides, on his ability to increase the production and the profits of a great mining concern on a maximum price of 13s. The fact seems to be that Chili will produce large quantities of copper, at prices lower than any hitherto thought possible, as the development of means of communication proceeds, and improvements in the methods of mining and treating ores are introduced. And this seems to be true, though, perhaps, not quite to the same extent, of the other great centres of production. There is copper in almost all parts of the world, and it may safely be asserted that a great deal of it will be worked, even if prices should fall still lower. The supplies which will be forthcoming from Colorado alone—an entirely new field, in which Chinese labour will soon be largely employed—will have an important influence on the value of the metal. And the quantity of copper produced, at a cost popularly supposed to be very small, from pyrites first treated for sulphur, is now so large, and is being so rapidly increased, that it must be taken into account in any attempt to forecast the probable course of the market.

The traditional policy of the English smelters was to maintain prices at the highest possible level, but their occupation as mere smelters is now almost gone, and their power to lay down the law to producers and consumers alike has gone with it. They depend now chiefly on the demand for manufactured copper, and smelt only for their mills, being generally undersold in raw. The mill power in this country, and on the Continent, is greater than can be profitably employed at the present rate of consumption. Hence a severe competition for orders for manufactured copper and yellow metal, and a consequent pressure to sell at lower and lower prices. This competition is aggravated in the case of yellow metal by the diminished consumption, resulting from the substitution of iron for wood in shipbuilding. This changed state of things has produced its natural result, and the smelters now begin to see that in the absence of new inventions, involving an extensive use of copper, their only hope lies in stimulating consumption in the ordinary channels, which can only be done by reducing prices more and more. They have, therefore, no longer any motive for seeking to uphold values.

From the considerations I have indicated—for it is not possible to discuss the whole matter fully in the compass of a letter—I should draw the conclusion that while manufactured copper is, no doubt, too low, copper in ores, regulus and slab fetches now as high a price as supply and demand warrant, and that the theory of extreme depression is founded—

1.—On an erroneous assumption, drawn from Cornish experience as to the cost of production in Chili, &c.

2.—On the supposed duty and interest of the English smelters to maintain high prices; and

3.—On the existence of a scattered but still hopeful remnant of speculators, who cling to the belief, and try to propagate it, that the old times of high prices will some day return.

NOSIRIS.

## COPPER MINING IN LAKE SUPERIOR.

SIR,—Since I wrote last the Aztec Mine, Ontonagon County, has suspended operations entirely. This is a small concern, and has had a fitful sort of existence, but its stoppage leaves the working mines of the county one less. From information received a few days ago I learn that the total force of miners employed in the mines of Ontonagon County do not exceed 130. A few years ago the Minesota alone employed twice that force.

The Pewabic Mine, which produced last month over 40 tons of copper, has been compelled to almost stop for the winter months, for want of a rope with which to hoist. Last fall they got up a steel wire-rope, which was imported from England, and which it was supposed would certainly put them through the winter. It failed about the close of the year, and, as another could not be obtained in the country, operations generally had to be suspended until a rope can be forwarded overland from below. I believe three of these steel wire-ropes were brought up last fall, two of which are yet being used at the Franklin Mine. None of them have answered expectations. There is no perceptible wear of the rope, but the wires break as if they were not properly tempered.

A Drilling Machine worked by compressed air is being tried at the Central Mine; this is the first of the kind yet used in the country. Two steam drills were tried, but the exhaust steam rendered it impossible to use them advantageously.

The shipments of copper from fourteen mines in the Portage district was as follows:—

Minerals shipped for the year 1869 .....	2765 tons 1064 lbs.
Refined copper ditto .....	6538 tons 920 lbs.
Total .....	9303 tons 1984 lbs.

For the month of December, 1869, the Hecla product exceeded 405 tons: the Calumet, 234 tons. From the latter mine no mineral was weighed off, except that produced from the stamps, the heavier pieces, barrel work, &c., being allowed to remain underground.

There is no improvement in the price of ingot copper since last month; the stock on hand in New York is said to be 5500 tons. Next season we look to have cheaper provisions. This will admit of a reduction in rates of wages, without seriously affecting the labour. The reduced gold premium must also affect the cost of supplies, and it would seem that in looking for success we have to depend more on a diminution of the cost of production than on any material advance in the price of copper.

We have been having very stormy and cold weather; thermometer ranging as low as 15° below zero.

MINER.

Keweenaw County, Michigan, Jan. 27.

## MINING IN CALIFORNIA—GREENHORN MINE, GRASS VALLEY.

SIR,—This mine was first located in early days, and has suffered through many changes, having been repeatedly sold and leased, the alternate parties being stimulated by the quantity of gold washed from the croppings, and also in casually finding rich specimens. This gave them an opportunity to hold and work the mine on the system of barter, when by so doing some few of the operators made money and left the country. Some eight or ten months since this mine was again leased for a term of five years, with the privilege of buying the property at the end of twelve months. This party, following the wake of their antecedents, went to work in real good earnest—sunk a shaft some 80 feet deep, and drifted about 60 feet on the ledge. The rock taken from the shaft and drift paid well; besides, if I am rightly informed, \$1500 worth of specimens was taken out in three days. I do not for a moment dispute the statement, as we have done even better than that during the past week. However, the party in question, for want of air, had to suspend operations in the drift; but, nothing daunted, they commenced and brought in a deep tunnel. Being men of limited means this dead work pretty much drained their resources, and not striking the lode particularly rich some contention arose, when a few of the party offered to sell out. A gentleman from Grass Valley, availing himself of the opportunity, purchased (upon my report) one-fourth of the mine, and immediately erected an eight-stamp mill. Previously the rock had to be hauled from four to five miles to be crushed; the milling and hauling cost \$7 per ton. With our mill on the mine we can work and mill the rock for what it formerly

cost in hauling and crushing. The average of the Greenhorn ledge is about 4 feet wide, carrying a variable stringer of mineral-bearing quartz on the footwall. In the stringer, or, I may say, branch, are to be found laces of almost solid gold, from one-eighth of an inch to three-quarters of an inch wide. Some of the specimens are so tenacious that after the rock containing the stringer has been broken they will in some instances hold together till twisted or pulled asunder. Yesterday (29th) the said branch was 5 inches wide, but the gold was more disseminated; nevertheless, it is wonderfully rich, so much so that one of the miners offered to lay me a wager that he could take out \$1000 worth of gold in three hours.

Our mill started up some two weeks since, when, after a few days run, we cleaned up; the result was \$27 per ton, not counting the value of the sulphurets, which are plentiful, and supposed to be rich. Here I may mention the fickleness of mining. Some little time since this mine could be had for a few thousand dollars in proportion to what it is worth now. To-day it is the richest mine in the district of Grass Valley, and valued at a high figure. With a 30-stamp mill in operation, the Greenhorn Mining Company can stand on their mine and triumphantly exclaim, "Behold! Greater than Eureka is here."

Greenhorn Mine, Jan. 30.

CAPT. FAULL.

## "TERRA PONDEROSA"—BARYTES.

SIR,—"*Terra Ponderosa*," heavy earth or spar—"barytes" the popular name, and *vulgo*, "cawk"—is the native sulphate of an alkaline earth-metal, which, from its high specific gravity, has been termed "baryta" (derived from a Greek word, meaning heavy). Upon this much-neglected mineral and substance it is I wish to speak. Its chief use until very recently has been in the manufacture of colours—as a carrier, being perfectly inert and of great density, and as an adulterant; the price, consequently, low—hence its being regarded by miners generally as *debris*.

Modern chemists have paid much attention to the subject, and a variety of applications have been suggested; but, from some practical difficulty or other, many of them have gone again out of use—others have outlived these difficulties, and form now regular branches of industry. Amongst the most indefatigable in the cause of baryta has been Prof. Kuhlmann, of Lille (France); he formed compounds with baryta which were intended to supplant analogous compounds of potash, &c. He is one of the largest and earliest makers of fictitious sulphate, known in England as permanent white. Equally interesting are the researches of Boussingault, who discovered in baryta a new source of oxygen—baryta, acting as a carrier, absorbing and discharging oxygen at respective temperatures; this beautiful theory was in advance of the time, however, and will not be available until later. Subsequent to this a very important application of baryta sprang up, and for a time absorbed large quantities of material; this was the employment of sulphide of barium in the extraction of sugar from the beet-root, carried on most successfully in France and Belgium, until suppressed by the Government on account of its poisonous character. Again, a most beautiful use of it is as a substitute for lead in the manufacture of glass; for this purpose it is used both alone and in conjunction with zinc. Works for the manufacture of barytic glass have already been established at Clichy, near Paris, and are capable of great extension. These are a few of the most important suggestions in the field of baryta of past years, with the exception of one—a soda process, which is not much used; and from these it is apparent that baryta is beginning to claim a legitimate position amongst mineral products.

We come back now to the material for which these processes have been planned, and applications suggested, viz.—*Terra ponderosa*, for it is this mineral which forms the great source of baryta. There exists another barytic mineral, witherite, or carbonate of baryta, but the occurrence of it is so rare that any larger industrial application of it would soon exhaust it; but Nature is so prolific in the store of native sulphate that the supply may be looked upon as inexhaustible. It is this sulphate, then, that has been an object of interest to me for years, and I think I have shown in the few technical references above that it has formed the study of others, and that, therefore, it is something deserving of interest. But for a time I had abandoned these researches, when some friends induced me to resume them, and through whose medium I undertook the conversion of native sulphate into marketable baryta products for a company commensurate with the locality and capabilities of production. The deposit upon which I ventured is a most extensive one; the locality, as regards abundance of power, favourable, but beset with many difficulties of a subordinate nature. Here upon this spot have we commenced reducing baryta upon a plan never before attempted, and converting it into a salt of baryta, for which such a demand has sprung up that we can sell more than it is possible to make with our present appliances, and it is merely a matter of plant to be able to realise a sale of 300 or 400 tons per month, with an amount of profit sufficient to pay handsome dividends upon the whole capital. This in a lone and rugged valley of Mid-Wales, where the processes had to be modelled and re-modelled, and rendered adaptable to the local requirements and resources, and amidst the murmuring of doubting shareholders.

I need not place my finger upon the exact spot, for it will be known to all interested, and for the present I cannot afford more time, but will return to the subject as soon as the improvements are secured.

PURE WHITE.

## CRUSHING MACHINES.

SIR,—I am very sorry to observe, in the Supplement to last week's *Journal*, a letter from Mr. Marsden, of Leeds, respecting my machines.

He states that such machines are infringements of Blake's Patent, and to illustrate this fact to the public he gives a drawing (in section), which he declares represents one of my machines. Now, the truth is that the drawing is that of a purely imaginary machine, which bears no resemblance to mine! I cannot, indeed, detect any one point of similarity to my crushers, consequently I can only conclude that Mr. Marsden is still labouring under some strange misapprehension, notwithstanding the infinite pains I have taken to make the character and form of my machines clear to his mind.

Upon the question of an "infringement" of Blake's Patent, I need say very little. I have made every effort to avoid litigation with Mr. Marsden, by pointing out to him the essential points of difference between the two patents; and he has told me that he would write to his three partners (the Brothers Blake) in the United States, and obtain their opinion upon the matter, on receipt of which he would write to me on the subject, which he has not done yet. I asked him the plain question, "Tell me candidly, do you intend to take any legal proceedings with a view to stop me?" To which he replied, "No, I will do nothing on my own judgment. I have only a fourth share in the patent, so I will consult my three partners, and then let you know what their opinion is." This promised communication has never yet reached me, although many months have elapsed. Mr. Marsden at the same time, and also since, in writing, offered very kindly to construct my said machines for me at a cheaper rate than I could get them made for in London.

I submit that the question of "infringement" cannot be decided in your columns, therefore I shall trouble you with no further correspondence on the subject. I have beside me the case of "Blake v. Archer," with the Vice (now Lord) Chancellor's lucid judgment therein, and I am well assured that my patent machines in no way infringe upon Blake's Patent.—London, Feb. 23.

L. WRAT.

## QUARTZ CRUSHING MACHINERY.

SIR,—I am perfectly astonished at Mr. Marsden's letter, which you published in the Supplement to last week's *Journal*. As to the sectional sketch which accompanied it, no one can deny that it is a marvellously clever production, and confers much honour on the engineer who designed it. I shall not venture any remarks upon the vexed subject of "infringement of patent," but this much I will say, and vouch for—that Mr. Marsden's sketch is altogether unlike Mr. Wray's crusher. As Mr. Marsden says that he has seen this gentleman's machine, I am at a loss to account for his so very strangely misrepresenting it. Myself and scores of gentlemen interested in British and foreign mines have also seen these machines, and cannot fail to perceive that their construction is totally different to the sketch presented to the public by Mr. Marsden.

J. B.

London, Feb. 24.

[For remainder of Original Correspondence, see this day's *Journal*.]



## MINES REGULATION AND INSPECTION BILL.

HOUSE OF COMMONS, FEBRUARY 21.

Mr. BRUCE, in moving the second reading of this Bill, said this was not only a consolidation of all the Acts relating to the inspection and regulation of mines, but also embodied those principles which, after due consideration, the Government thought should be included in the Bill. It was not his intention to trouble the House with a history of past legislation on this subject; he would only state the chief amendments embodied in the Bill. The House would recollect that the first legislation upon mines was effected in 1842, when the subject was brought under the consideration of the House in a speech of great power by the present Lord Shaftesbury, then Lord Ashley. That Bill was introduced in consequence of the report of a Commission describing the condition of the mining population of Great Britain. He would ask those who were naturally impatient at the number of accidents and terrible calamities which from time to time occurred in mines to glance at the speech of Lord Ashley, and then to compare the condition of the mining population at that time and the present. Children of tender years—eight, seven, and even five years of age—were then employed underground. Women were also employed underground in degrading tasks. The men were in a state of ignorance with which their present condition, although unsatisfactory, contrasted most favourably. The Act of 1842 provided for the cessation of the employment of women underground, and prevented altogether the employment of children under ten, but made no provision for the education of children employed in mines. It also provided for the inspection of mines, and Mr. Tremere, who had since examined many a dark corner of our social system, was appointed sole Inspector of Mines, and so remained until 1850. In that year the number of Inspectors was increased to four, in 1852 to six, and in 1860 to twelve, which was the present number of Inspectors. In 1860 a Bill was introduced by the then Home Secretary, Sir G. C. Lewis, but it was prepared mainly by the then Under-Secretary, Mr. Clive, who displayed remarkable knowledge and zeal in the matter. The Bill became law, and another Bill passed two years afterwards, which imposed upon all collieries having a single shaft the necessity of providing an additional shaft, and prevented any mine being opened in future without two shafts. The present Bill embodied all those Acts, with certain amendments. He was, however, anxious to give some of the results which had been produced, not altogether by the interference of the Legislature, but which were due to the increased enlightenment of colliery proprietors, their spirit of humanity, and desire to consult the safety of the mining population. For ten years ending in 1860 the loss of life was equal to one for every 67,000 tons of coals raised. From 1864 to 1868 the proportion of loss of life was one for every 93,000 tons raised; while for the last year for which there were full returns (1868) it was one for every 103,494 tons. However great and deplorable that loss of life was, still if it had continued at the rate which it maintained between 1851 and 1860 it would have been 50 per cent. greater than at present. It might be assumed that the average loss was about 1000 lives a year, and but for the improvement that had been effected it would now be at the rate of 1500 a year. These colliers, who were engaged in a trade on which the manufactures and commerce of the country so much depended, numbered 350,000, and they raised each year 105,000,000 tons of coal from 3262 collieries. He would now refer to the causes of these accidents. Some of those causes were inseparably connected with the nature of the operations themselves, and some depended on the skill and energy, or the want of those qualities, on the part of those who conducted these operations. It was with the latter part of the subject that the Bill dealt. The utmost that could be done by legislation, or even by the greatest care on the part of those who had charge of mines, was to reduce the loss of human life. He feared, however, that nothing could prevent from time to time very considerable losses of life in mining. No doubt the best of all safeguards against explosion was an ample supply and a careful distribution of ventilation. The utmost care, however, could not prevent deplorable accidents from the sudden outbursts of gas. The greatest cause of the loss of life arose from the fall of the roof and the slipping of coal upon the unfortunate workmen: 400 deaths were due to these causes, and 200 only to explosion. Three-fifths of the accidents were due to these causes, and one-fifth related to the shafts. There was much to be done by great care in averting accidents from these causes, but as long as men were men it was to be feared that deaths would occasionally occur. The remainder arose from miscellaneous causes, such as the bursting of boilers and accidents to children and young persons employed on the tramways and wagons on which the coal was borne. The first means for the removal of these causes of accident was, beyond all question, an improvement in the intelligence of all the classes of persons concerned in the raising of coal. There was, no doubt, strong need for that improvement. The Bill did not propose to deal at present with the examination of agents and sub-agents. Great difficulty would arise in the event of agents and sub-agents employed in mines being required to pass an examination, because the result of such an examination would be at once to remove from their employment half of their number, who, although perfectly capable of performing their ordinary tasks, might not be prepared to pass any sort of examination. He admitted that the question of providing a proper education for these persons was well worthy the attention of Parliament, and he regretted that up to the present moment that question had not received the attention it deserved. A few efforts had doubtless been made in Cheshire, Lancashire, and Cornwall to establish schools for mining agents, but those efforts had not been successful. Although great advances had been made by the colliery population in recent years in intelligence and in education, still much remained to be done in order to facilitate their advance in that direction. Mr. Dixon, in his report of 1868, attributed a great proportion of the accidents that occurred in collieries to the ignorance of the managers, the viewers, and the firemen, who were not only unable to read and write, but who were ignorant of the first principles which should regulate the work in which they were engaged. A great number of the accidents were, however, attributable to the workpeople themselves, who were generally rough, and in many cases disobedient, and who continually disregarded the specific rules. They ascended and descended the pits contrary to the published instructions. If the roof sounded well in answer to a blow of the hammer they neglected to secure it; they ran the trucks on the tramways in the workings at a reckless pace, utterly regardless whether or not any human being might be on the rails; and they opened and interfered with their safety-lamps in order to light their pipes. Of course, no Bill that could be passed by the House would prevent accidents caused by such reckless conduct on the part of the workpeople themselves. The Bill in the hands of members did not undertake specifically to provide for the education of the mining population, and he was anxious to explain to the House the reasons that induced the Select Committee to make the recommendations they had done, and to point out to hon. members the difficulties that surrounded the question before them. Under the present law no child was allowed to enter a colliery until he was at least ten years of age, and not even then unless his parents could produce a certificate that he could read and write, or would undertake that he should attend school twice a week for three hours each time. He need scarcely say that those provisions were totally inadequate to secure the education of the children. There was no security that the certificate would be given by a competent person, or that the examination would be more than a mere farce, and even assuming that the child could read and write tolerably when he commenced work, no provision was made to insure his keeping up and extending the knowledge he had already acquired. With respect to the second provision, requiring the child who had not obtained the necessary certificate to attend school twice a week, he submitted that it could only be effected in the case of a child who had already received a tolerable education. It was obvious, therefore, that, however excellent the Act of 1860 might have been in many respects, it had utterly failed in the matter of education, and notably from the want of co-operation on the part of the parents. The working of the Act with respect to education was very graphically described in a report made by the Assistant-Commissioner on Education in Scotland. Mr. Sellar said (p. 27)—

"When that Act was passed, providing that children under 13 years of age should produce certificates of school attendance, it created a considerable sen-

sation among the miners. In one coal-mining school the teacher complained that the colliers had been in the habit of first coming to him and threatening to maltreat him if he ever refused a certificate. Of course, a weak-minded schoolmaster would succumb at once, and sacrifice his conscience to his safety. At another school we are told that just at first certificates were given, 'but none had been demanded for a long time.' At another, none had been given for 14 months; and in one pit, in a colliery in Yorkshire, we found that 46 per cent. of the young people employed could neither read nor write, and that 8 per cent. could read a little, but could not write a letter. Lamentable accounts were given on all sides of the state of brutish ignorance in which the people connected with this colliery were living. Everyone asserted that the children were taken down before the statutory age. 'I know they used to be taken down very young,' one informant said, 'a teacher who had once taught a school in the neighbourhood, because I kept a night school for the mining children, and very young ones—poor, white, stunted things—came to it unable to read a word or write a letter.' Mr. Sellar went down into the pit and investigated matters for himself. He found 13 boys. "None of them," he adds, "looked much more than 12 or 13, and some had been five years in the pit." The result of the investigation was this:—

"Of the 13, six could both read and write, one could read a little, and six could neither read nor write. Of the six who could both read and write four were Scotch and two Irish. Of the seven who could not write, five were Scotch and two Irish. Five of these seven children had never been at school at all, and did not know a letter. The other two had been at school, one for four or five years, but they had forgotten all they had ever learnt."

If that was the result of the Act in Scotland, where there was such a reverence for education, what was likely to be the case in this country? Why, in most instances either the Act was disregarded, or else a rule was made by which no child under 12 was admitted. Various plans and suggestions which had been made upon the subject were to be found upon the notice-book in the form of amendments which were proposed when this Bill was before the House last session. The first of those amendments was that proposed by the hon. member for the University of Edinburgh, and was to the effect that it should be lawful to employ a child under 11 years of age, provided he had obtained a certificate from a schoolmaster whose school was inspected by one of Her Majesty's Inspectors that he had passed a certain examination. This proposition had the advantage of defining exactly the amount of education which each child was to possess before commencing work in the mines. For his own part, he trusted that the result of the establishment of a system of national education would be to render all enquiries into the condition of a person before he was allowed to enter a certain class of work unnecessary. The hon. member for Coventry by his amendment proposed that the present system should remain in force, but he thought that he had clearly shown the imperfections of that system, and the necessity that existed for reforming it. Then came the amendment proposed by the hon. member for Halifax, supplemented by that of the hon. member for Brighton, which together formed the most efficient of all the proposals which had been made on the subject. The hon. member for Halifax proposed that the employment of children should commence at 10 years of age, but that until 12 they should be compelled to attend school three times a week for four hours each time, making a total of 12 hours schooling in each week. In his opinion children should not be allowed to work at all until the age of 10 (hear, hear), and he believed the application of the Factory Acts half-time system would never succeed if applied to mines. Then came the recommendation of his noble friend the member for Haddington, which proposed that children should not enter a colliery before 12 years of age; that boys between 12 and 14 should devote six hours weekly to education, and that, with respect to boys above ground, the six-hours education should be continued until their 16th year. His objection to this proposal was that there was no security that boys would be taught during the time they were taken from their work. The working miners proposed that no youth should be employed before he was 12, and not even then unless he could read and write, his ability in this respect to be certified by the Government Inspector. His objection to this scheme was that it could not be said schools were sufficiently numerous to insure the education of every youth in the colliery districts, and that not half of the schools which did exist were visited by a Government Inspector. The proposition of the Government was to exclude children under the age of 12, and to leave it to their parents to see they were educated by that time. No doubt the measure would be incomplete in itself in the matter of education, but he looked to the Bill of his right hon. friend (Mr. Forster) to supply its deficiencies. In Germany boys were not allowed to enter collieries until a more advanced age; but, having once entered, no further provision was made respecting them; and yet Mr. Sandford, Inspector of Schools, found in the course of a stay in Germany that out of a band of boys he met leaving a colliery only one was unable to read from a volume of *Goethe*, and that was from a defect in his eyesight; and of the remainder only one could not read fluently. What would be the result if a band of boys leaving a colliery in England were required to read a passage from *Shakespeare*? As to the duration of hours, the Government proposed that no person under 16 or above 12 should be employed underground more than 12 hours a day, including one hour and a half for food and rest. His experience went to show that there was nothing in this arrangement inconsistent with their health, while it certainly enabled them to earn good wages for their families. In many districts a boy of 12 could earn 9s. a week, and some boys earned 11s. It was also proposed that the provisions of the Workshops Regulation Act, 1867, should apply, as this would prevent the employment of the few women at present occupied in collieries at night, and would also prevent the employment of children at improper times. Another improvement suggested by the Bill was that a register should be kept, in which the name of every boy under 16 should be registered. The provisions of the Bill relating to weighing applied both to coal and ironstone mines, and to all metalliferous mines whatever. One of them was aimed at settling a disputed point between the masters and men. The law at present allowed workmen to weigh coal, but it was doubtful whether in the case of any misconduct on the part of the weigher the master had the power to remove him, as he was paid by the workmen, though appointed by the master from among their number. The Government proposed to make the weigher irremovable except on the order of a magistrate, in consequence of misconduct proved before him. Another provision much asked for by the miners was that the weights and measures should be under the inspection of a Government officer, and this was granted. The next and most important part of the Bill applied to the safety of the mine, and in this a considerable number of alterations had been made at the suggestion of the Select Committee. In the first place, it was required that proper ventilation should be continually kept up. The law as it stood required owners to see that such an amount of ventilation should be kept up as would prevent accidents under ordinary circumstances; but it appeared from evidence given before the Select Committee that those words were used by the magistrates unduly to relieve the coalowners from the obligation cast upon them; it was, therefore, provided that the ventilation should be perfect. It had been objected to this provision that it threw upon masters the burden of proving that they had provided sufficient means of ventilation, and that the accident was caused by some extraordinary means. This, however, did not seem to him to be unreasonable. The master would not be without evidence to show the supply of air was sufficient if the proper means for ventilation existed, nor would it be difficult to show that there was a sudden outburst of gas or a sudden interfering with the air passages if the accident had arisen in either of these ways. In spite of that, of course, an accident might happen; but any Judge on trying the case would perceive that it was due to some extraordinary cause. One of the witnesses examined before the Select Committee mentioned an instance where his insisting upon a larger supply of ventilation than had previously been used resulted in a dreadful calamity being averted. In the mine in question he found on his first inspection that there were only 12,000 cubic feet of air in a certain space, but by constant pressure, applied by his direction, the quantity was gradually increased until it amounted to 80,000 feet. Immediately after this had been done there burst out a quantity of gas greater in volume than he had ever known to escape, and had it not been for the augmented supply of air it must have met with a naked light before being diluted with a quantity of air sufficient to render it harmless. The right hon. gentleman explained that this dangerous gas did not ignite till it was mixed with four times its quantity of air, and that it continued explosive until it was mixed with fourteen times its quantity of air, when it ceased to be dangerous. If, however, it met, in the meantime, with a naked light an explosion would be the immediate consequence, and perhaps every collier underground at the time might be killed,

It seemed to him that there ought to be in every mine a surplus supply of air over and above what was required under ordinary circumstances, and he should be ready to consider any suggestion which might be made for altering the clause, provided it were consistent with the main object in view—the securing of an ample supply of pure air. One recommendation of the Select Committee had not been embodied in the Bill as a general regulation. It had reference to the coalowners providing timber for the purpose of preventing the downfall of the roof. That matter ought, in his opinion, to be dealt with by special rules rather than by general regulations, and he should, therefore, not be unwilling to revise the regulations now in force on the subject. The next alteration to which he would advert related to the mode of conducting arbitrations. Under the present system, when a dispute arose between an Inspector and a coalowner as to whether sufficient provision had been made for the protection of a colliery, the coalowner named five persons as arbitrators, and from these a selection was made by the Secretary of State. This mode of procedure had been found inconvenient in many ways, and it was, therefore, provided by the Bill that in disputes of this kind the old-fashioned mode of arbitration should be followed, each party naming one arbitrator, an umpire being appointed in the usual way, and the costs apportioned by the arbitrators themselves. The next subject was that of inspection, but it was not proposed to introduce any alteration in this respect into the existing system. He was fully aware that in many quarters a strong desire was felt for an extended system of Government inspection, but he was not prepared to recommend any considerable addition to the present number of Inspectors. He would state the reasons which had led him to this conclusion. It was clear that originally the Inspectors were not intended to perform the tasks which they were now called upon to undertake, of visiting every colliery once a year. Indeed, the number of Inspectors appointed in the first instance showed that such an intention could not have been entertained. At first only one Inspector was appointed, but five others were afterwards appointed, and the present number of Inspectors was 12. In some quarters it had been suggested that all mines should be visited by a Government Inspector every six months, while the working miners were of opinion that the inspection should be renewed every three months. Juries had also on several occasions, and particularly in both the cases arising out of the lamentable and fearful accidents at the Ferndale Colliery, recommended a quarterly inspection of mines. Now, he would not refer, except for a moment, to the mere cost of carrying out such a proposal. Several Inspectors whom he had consulted on the subject had informed him that there were in their respective districts mines which they could not properly inspect under three or four days. One Inspector, indeed, stated that one of the mines in his district could not be thoroughly inspected under 14 days; while another—Mr. Atkinson—mentioned one colliery the mere cursory inspection of which would render it necessary for him to travel 88 miles, and at least half of the distance with his back bent double. He had endeavoured to ascertain what number of Inspectors would be necessary to satisfy, even in the most cursory manner, this demand for a quarterly inspection of mines, and he did not believe it could be done without at least 200 Inspectors. Moreover, he was of opinion that the result instead of being advantageous to the colliers would be directly the reverse. (Hear.) He earnestly hoped that the House would pay serious attention to this question, for it was absolutely impossible that in a matter of such a kind there could be divided responsibility. (Hear.) The more responsibility the House threw upon the Government, the more they would relieve the coalowners from responsibility. Perhaps six, ten, or even twenty additional Inspectors might beneficially be appointed, and if it were found that an addition was required it should be cheerfully made; but a quarterly inspection of mines would demand the large number of Inspectors to which he had just alluded, while the result would be that whenever an accident occurred the coalowners would exempt themselves from responsibility, on the ground that the Government Inspector had recently visited the mine, and certified that its condition was satisfactory. The only effective inspection was that conducted by the owners and managers of the mines (hear, hear), and on this point he would refer to a statement made by Mr. Atkinson, which showed how the very best system of inspection might be carried out without any Government aid. Mr. Atkinson stated that—

Mr. Daglish, the mining engineer and general manager of Earl Vane's Collieries, has organised a system of voluntary inspection at many of the collieries under his charge, by which some of the workmen are made to examine all parts of the mine at stated intervals, to ascertain, as far as they can, the state of the air-ways, and to consider the general state of the mines with respect to safety, and to report in writing to him the result of their inspection and investigation; and I have reason to think it answers a good purpose, and gives general satisfaction to the workpeople employed in the mines; and I should anticipate receiving, as Inspector of Mines, a complaint from the workmen if they found anything dangerous and requiring my attention, unless the danger was such as to admit of being quickly remedied, and the agents arranged to have it rectified at once. This practice of the men taking into their own hands the inspection of the collieries was self-working; it operated every way, it met every danger as it momentarily arose; and he was also glad to say it was not restricted to the district inspected by Mr. Atkinson, but was established in many other parts of the country. A large coalowner in his own part of the country stated to him that he not only encouraged his workmen to give notice of any danger which might be apprehended, but he always gave a money reward to any workman who discovered any real danger. (Hear, hear.) He believed that in the enormous majority of cases the employer or head agent would not neglect any caution so conveyed to them. The system he had just described was one of mutual confidence which ought to exist between master and men. The Government might contribute to their safety, but only in a very slight degree, and he, therefore, implored the House not to sanction any material departure from the system already in force. He had seen it asserted, he believed, by some member of that House during the recess that he had said the only duty of an Inspector was to go to inquests and examine into the causes of accidents after they had happened. Now, he denied that he ever made such a statement. An Inspector ought to acquaint himself with the general condition of the collieries, and it was also his duty to pay attention to any warning given to him of danger existing in a mine. Indeed, there was not a single Inspector who had not during the past year received many such notices, or who had not immediately acted upon them. He felt satisfied that the substitution of Government agency for the natural interests of the masters and workmen could not be attended by beneficial results. There remained, he was happy to say, but one subject on which he need detain the House, and that was the alteration with respect to penalties. Under the Act as it now stood the infringement of the rules by the owner or his agent was punishable by a fine of not more than 20*l.* and not less than 2*l.*, with a continuing penalty of 1*l.* for every day the offence was committed after the receipt of notice. Infraction of the rules by the men was also visited by fine, or, if the offence was sufficiently aggravated, by imprisonment at the will of the magistrate. The workmen had justly expostulated at this distinction, and it was his belief that if it could be shown that there had been any neglect on the part of the owners or their agents, and that this neglect had knowingly been committed, they ought to be liable to imprisonment as well as the men, especially as there was in their case greater knowledge and less excuse. (Hear.) In connection with the last Fernley Colliery explosion, it was proved that several of the workmen had warned the viewer of the danger that existed in certain parts of the mine. He neglected to take any precautions, and the result was that an explosion occurred, by which upwards of 100 persons lost their lives. It certainly appeared to him that if no such explosion had occurred the negligence of the viewer was as deserving of imprisonment as would be any infraction of the rules on the part of the workmen. (Hear, hear.) He perceived that only lately a workman was sentenced to three months' imprisonment for lighting his pipe in the mine, and there could be no doubt that the punishment was a just one; but, considering the danger which attended neglect on the part of the owner or his agents he thought that it was simply a measure of justice that both parties should be liable to the same punishment. (Hear, hear.) There was doubt, too, that at present a workman when punished received a great deal of sympathy from his fellow-workmen if he were sent to prison, and that if he were fined the money was subscribed for him. This was the case even when his offence was one which exposed the lives of his fellow-workmen to great danger, and he believed that when the masters and workmen were placed on the same footing this feeling would to a great extent disappear, and the work-



men would take a juster view of their duties towards each other, and who by their recklessness imperilled the lives of others. (Hear, hear.) He trusted that the House would accept these alterations, and assent to the passing of a measure which had already received the approbation of both masters and men.

Dr. PLAYFAIR corroborated the right hon. gentleman that four-fifths of the accidents in collieries were due to mechanical causes, and one-fifth to chemical causes, and that a more extended acquaintance with mechanics would tend materially to reduce the number of accidents. The deaths from accidents arising from chemical causes numbered about 200 in the course of the year—scarcely more than occurred from the ill-regulated traffic in the metropolis. The former, however, excited more sympathy, because, instead of happening in isolated cases, 50 or 100 men were usually swept away at a time. Accidents in collieries had increased since 1815, when Sir Humphry Davy discovered the safety-lamp, partly from the fact that more mines had been opened, and partly because miners were now enabled to open fiery seams which they had previously not dared to attack. Since 1835 there had been abundance of enquiries by parliamentary commissions and committees on the subject of mines, and their recommendations resolved themselves into two main conditions of security—full responsibility and competent knowledge on the part of employers and employed. The responsibility rested primarily upon the owners and the officers of mines, and should always be sharp and well-defined. He was, therefore, glad to find that the proposal of the right hon. gentleman did not in any way contemplate a diminution of that responsibility. With regard, however, to competent knowledge on the part of employers and employed, he was not satisfied with the provisions of the Bill, and he was glad to hear the right hon. gentleman state that that must be the subject of future legislation. The main security for the health of the miners and safety against explosion was sufficiency of ventilation, which in coal mines, though, of course, far more complex in its character, was conducted much on the principles of ventilation in that House. But, in addition to the magnitude and extent of the workings in many of the collieries, there was the danger arising from sudden outbursts of gas, and from a change in the barometer driving foul air into the ordinary workings from the "goafs," or vaulted arches, where it was continually being generated. With no such dangers as these to guard against, the House, nevertheless, did not in their own case leave the ventilation solely to the hands of experienced servants, but committed the whole business to the care of a chemist of high eminence. The miners had petitioned that the deputies and overmen should be subjected to a scientific examination previous to the mines being placed under their charge. The masters and the mates of ships were compelled to undergo examination, and it was quite as reasonable that those by whom the working of mines was superintended should be subjected to a similar ordeal. As the right hon. gentleman had explained, however, there were difficulties in the way. There were viewers of great experience and utility who could not pass an examination; but the same difficulty had to be met when Parliament had set about protecting those who were engaged in navigation, and it had been successfully overcome; so that seamen had now the advantage of the ability which was testified by the possession of a certificate. Let him remind the House that a series of Commissions had been appointed to enquire into the subject, the first of which consisted of Sir C. Lyell and Prof. Faraday; the second of Sir H. De la Beeche and himself, and the third of Prof. Phillips. All those persons had made special enquiries as to the most effective means of diminishing the number of accidents in mines, and had come to the conclusion that that object could not be attained without increased superintendence and a greater degree of intelligence on the part of the workmen. He would not weary the House with quotations, but he might observe that one of the most eminent physical philosophers this country had produced—Prof. Faraday—had stated in his report his belief that if the education of the miners generally, and especially of those who were set over them, could be materially improved, it would conduce more to the security of life than any system of parliamentary inspection which could possibly be devised. He regretted the Committee of 1867 had not recommended a change in that respect. They, however, were not unmindful of its importance, which had been signally illustrated in the enquiry into the Haswell explosion. He himself had descended the Jarrow Mine, when 600 acres were filled with explosive gas. The ventilation had been disturbed, and could not be re-established except by sending water down the shaft. The safety of the exploring party depended upon the exercise of the highest intelligence which could be afforded them in the mine; but they found that their two guides, the deputy-foreman and the waste-master, could neither read nor write. The right hon. gentleman had stated to the House how defective education was among the mining population. The Committee of 1867, however, did not take the schools of the mining districts out of the national system, but suggested that the instruction given in those schools should be regulated by the circumstances in which the population were placed. Now, he was unable to understand why it should be, but he presumed the Committee of Council had never paid any attention to that suggestion. He should like to know why persons employed in mines should not be instructed in the principles of the safety-lamp, and made to know that when the gauge of such a lamp was pierced in order that the miner might light his pipe it became a lamp of danger. Nor could he understand why the men should not be taught something of the properties and uses of timber, as applied to supporting the roofs of the mines. Those were very simple elements of knowledge, but in this country they seemed, nevertheless, to be placed beyond the range of miners. He merely wished to add that he did not in the least desire to oppose the Bill before the House. He looked upon it as a Bill wisely drawn and calculated to do good. It would be very wrong in him to let it for a moment be supposed that he was ignorant of the zeal of the right hon. gentlemen the Home Secretary with the object of imparting useful technical knowledge, but he hoped the mining profession would understand that when the Bill was discussed it was in the belief that they were not getting that full amount of security which was desirable, and that it would be necessary, if to establish safety in mines was their object, to supplement the Bill by another measure for the purpose of providing that scientific knowledge on the part of the viewers and superintendents without which we must expect a constant succession of accidents. (Hear, hear.)

Lord ELCHO was glad that the hon. gentleman who had just spoken, and who had acquired personal knowledge of the question under discussion as a member of a Government Commission, had given the House the benefit of his views with respect to it. The importance of the Bill, of which the Home Secretary had moved the second reading, could scarcely be overrated; indeed, considering that its object was to provide for the safety of a population of 350,000 persons, it was almost worthy of ranking with the two great measures which the Government had already introduced. The utility of the object which the right hon. gentleman had in view being admitted, the question was how that object could best be attained. How far, then, did the Bill represent the opinions of the miners themselves, and how far were its provisions approved by the employers? Last year three or four conferences had been held between the miners and the owners. The hon. member for North Durham, who employed 10,000 men, and who had great personal experience in the working of mines—for he had stated before the Trades' Union Commission that he had begun life in the pit—the hon. member for the City of Durham, the hon. member for Wigan, the hon. member for Stoke, the hon. member for Wednesbury, and the hon. member for East Stafford, who then conferred with the miners, might be taken to represent the most intelligent views entertained among coalowners in that House, and they had been met by a most intelligent body of working men. If anyone doubted the value of conciliation and arbitration between operatives and their employers he should have witnessed the frank and manly spirit in which they had been met by the men, and in which questions in which both parties were interested were discussed. The result of the meetings which had been held last year was that certain amendments were agreed to and placed on the table of the House. On Friday last the hon. members for Wigan and Stoke had an interview with two delegates of the miners, and they had gone through the Bill and the amendments to which he had just referred. As to education, they had not discussed that subject, because they thought

it would have been, so far as they were concerned, brought within the scope of the general educational Bill of the Government. But there were other points of great importance to which their attention had been directed. The measure before the House provided that no child under the age of 12 should be employed in a mine, but that between the ages of 12 and 14 children might be so employed for 12 hours a day, with an hour and a half's interruption for meals. Ten hours were, however, to be allowed to elapse between the periods of their employment, and thus practically the children might be employed for 84 hours a week instead of 72. Last year the position taken up by the miners was that 18 hours should be allowed. But a compromise was arrived at, by which children between the ages of 12 and 14 might work 50 hours in the week, and children between 14 and 16 years 56 hours a week; but in no period of 24 hours were they to work more than 12 hours from bank to bank—that was to say, from the time when they went down into the pit till they emerged again into the light of day. The coalowners laid great stress upon the need of non-interference with the running of their machinery, and of being able to run this for ten consecutive hours; but eventually the compromise which he had mentioned was arrived at. He hoped his right hon. friend would not object to the insertion in the Bill of some provisions giving effect to it—at least that he would not refuse to give it his favourable consideration. One amendment had been inserted which was perfectly fair, and was clearly in favour of the employers—this was that if the master objected to the weighman whom the men might appoint he should have the power of going before the magistrate and getting him dismissed. He next came to the question of registry. There was to be a registry of young persons under 16 employed in mines. At the meeting on Friday it was thought very desirable that this should be extended so as to include all persons employed in the mines, and an illustration was given of the need for such a provision. In one of the unfortunate accidents that had occurred it was impossible to discover whether a particular man was below at the time, and his brother, having searched for him incessantly for days and days, at last went out of his mind, the fact being that the missing man, without the knowledge of any of his family, had gone off to another part of the country, and was perfectly safe all the time. His right hon. friend proposed that of the 12 hours which children were to be allowed to work one hour and a half should be set aside for meals. The note which had been made on this proposal was, "Well intentioned, but impracticable." Persons well acquainted with the working of mines stated that children were employed in such very different modes—some with their parents, some with contractors, some in charge of doors or workings which they could not leave—that it would be impossible for them to give regularly an hour and a half to meals; the workings also were of such vast extent that it would be impossible, even with an army of Inspectors, to enforce the observance of such a rule. The 18th clause was thought to require amendment, as being too stringent in its terms. A mine in which ordinarily the ventilation was perfect might, through some accident which could not reasonably be foreseen, such as the liberation of gases by the falling of the roof, have the whole current of air displaced. Words ought to be introduced into the clause guarding its operation against a contingency like this, which might happen in the best regulated mine. The amendment which was proposed had been agreed to, both by the representatives of the men and of the owners of mines, last year, and this year they had endorsed their former decision. Last year there was a distinction between the penalties which could be imposed upon masters and men, the latter being liable in certain events to imprisonment, while the owners could only be punished with a fine. This year the penalties had been assimilated, and accidents produced by carelessness were now punishable in either manner, at the discretion of the Court. Both mine owners and miners, however, felt that the clause required to be very carefully guarded. As the matter stood both parties felt that they were liable to be caught in a legal mesh. A mine owner might be at a distance—attending the Eccumenical Council, for instance (a laugh)—and in case of accident might be summoned home to undergo imprisonment. Since he entered the House that evening the same point had been suggested to him even more strikingly. Lord Granville, who was a great coal owner, might be leading the deliberations of another assembly, and be called away to answer for carelessness on the part of some of his viewers or his managers if an accident in one of his mines led to loss of life. (Hear, hear.) But the real question, after all, was inspection. (Hear, hear.) On that the miners felt more strongly than they did on any other. The name of "Inspector" was a misnomer (hear, hear), for the Inspectors did not profess to go into the mines; they merely held an enquiry when an accident had occurred. Accordingly, they might with much more truth be called "accident enquirers." Any attempt at inspection under present circumstances must obviously be a farce. With a staff of only 12 Inspectors it was impossible to attempt it; and his right hon. friend did not propose any change in the number of the Inspectors, though he pointed out that by the consequences of what they had already done the ratio of deaths from colliery accidents had been materially reduced. He accepted the statement of his right hon. friend, that if the number of deaths in proportion to the quantity of coals raised had continued at its former level we should now have 1500 deaths annually, instead of 1000. But that was an argument for going further in the same direction. (Hear, hear.) And whatever might be the present duties of the Mine Inspectors, the wording of the Acts of Parliament under which their office had been created clearly showed that the intention of Parliament at the time those Acts were passed was that there should be a *bona fide* inspection. The preamble to the 13th and 14th Victoria, cap. 100, ran thus:—"Whereas it is expedient that provision be made for the inspection of coal mines, be it enacted" that the Secretary of State do appoint Inspectors. Under the 18th and 19th Victoria additional Inspectors were appointed. The 23rd and 24th Victoria (1860) repealed the former Acts, save as regarded the appointment of Inspectors, and section 16 of that Act was as follows:—

"It shall be lawful for any Inspector to enter, inspect, and examine any coal mine, colliery, or ironstone mine, and the works and machinery belonging thereto, at all reasonable times by day or night, but so as not to impede or obstruct the working of the said coal mine, &c., and to make enquiry into and touching the state and condition of such mine, and the mode of lighting or using lights in the same, and into all matters and things connected with or relating to the safety of the persons employed in or about the same, and especially to make enquiry whether the provisions of this Act are complied with; and the owner is hereby required to furnish the means necessary for such entry, inspection, examination, and enquiry."

The 17th clause was in these words:—"If any Inspector find any matter, thing, or practice dangerous or defective, so as, in his opinion, to threaten bodily injury to any person, he shall give notice to the owner or agent, and report to the Secretary of State."

If the owner objected arbitrators were to be appointed. The 19th clause was to this effect:—

"In case of accident, loss of life, or personal injury from explosions or other cause, the owner or agent is to report the same to the Inspector of the district." Now, he contended that those clauses would never have been so worded if it had been intended that the Inspector was to wait till an accident had occurred, or till somebody wrote and told him that there was danger. The Inspector was not to come into play just when the mine was in an abnormal state. They were not to lock the door after the steed was stolen. Looking to the plain English of the fact—looking to what was done in foreign countries, the system of inspection adopted in America, in France and Belgium—looking to the legislation they had themselves adopted for factories, he could not but think that the House might do one of three things—either carry out the wishes of the men that there should be proper inspection, no matter if it cost some money—an army of Inspectors—they had 40 or 50 factory Inspectors—or they might change their name and call these persons enquirers into accidents; or they might adopt the proposal of the member for the University of Edinburgh, that in all cases the overseers and managers of mines should be properly examined. This was a matter on which the miners felt most keenly. They looked on inspection as the whole soul of the Bill. At the meeting which was held on Friday he ventured to make the proposal, in order to bring about a better state of inspection, that each Inspector should be directed to inspect the mines in his district every six months, and report the state of ventilation, &c., to the Secretary of State. That was accepted by the men, by the member for Durham City, and by the members for Stoke and Wigan. When the House went into Committee he might think it his duty to try that question in the lobby. He hoped the House would be prepared to show that they were inclined to pay attention to the something like remon-

strance which had been addressed to them, and would urge the Government to give something more definite in the way of inspection than they now had. (Hear, hear.)

Lord MILTON quite agreed that they could not afford to do away with the inspection of mines. It was not just that every responsibility should be thrown on the shoulders of agents without any supervision and without the power of carrying out the rules and regulations they might make. It could not prevent accidents unless they were there personally. It was impossible to prevent men smoking; they would smoke, which not only endangered themselves but threw the onus of responsibility for any accident on those who were not responsible for their individual acts. With regard to inspection, he entirely agreed with the noble lord. He hoped, if Inspectors were not done away with altogether, they would be *post mortem* Inspectors.

Mr. PEASE thought his right hon. friend had taken quite a practical view of this matter. He was exceedingly happy in his attempt to consolidate the statutes relating to mines. The Bill promised inspection, which would materially add to the safety of those who worked in mines. He suggested that his right hon. friend should schedule at the end of his Bill the Workshop Act of 1867. He also hoped some little time might be allowed to elapse before they went into Committee on this Bill. The question ought to be fully investigated, not only by masters but by men, throughout the mining districts. With regard to education, he was prepared to go a good deal further than his right hon. friend. No boy under 12 years of age should be allowed to go down a pit unless he had a certificate that he could read and write. In well-regulated collieries boys under 12 were not allowed to go down a pit, but the consequence was that men who were most anxious to get the greatest amount of work moved off to collieries were little boys were taken in. Now he thought that acted harshly. He would give every mine owner who provided for the education of children belonging to his mine power to deduct 1d. in 12 from the wages of the men, provided that the children were sent to a school under Government inspection. The impression which was entertained of the rough and hard character of the miners would not bear the test of investigation. Comparing the wages of the miners in the district he represented with the wages of the agricultural class in the eastern and southern counties, he found that the amount of money received by the former would enable them to live much more comfortably than the latter. The result was that the morals, the whole condition, and education of the miners were much better attended to than those of the labouring population in a great portion of the kingdom. He had seen the rules and regulations of one of the large collieries in South Durham, and he could assert that it would be impossible for an ignorant man to carry them out, for the overman and his deputies had before the commencement of work to go down into the pit to ascertain that all the parts were in safety, and that they must pay due attention to the lamps and to the barometer. These were duties which could not be confided to ignorant men, and yet were daily and duly discharged by hundreds of persons in the coal districts of England. With regard to inspection, he would be the last to grudge any amount of it, but it must be remembered that the persons in charge of the mines were men of the highest scientific attainments, receiving 800*l.*, 1000*l.*, 1500*l.*, or even 2000*l.* a year, and the Government could not place individuals of inferior talents above them. The Inspectors must be their equals, and a sub-Inspector who might be an overman's brother or brother-in-law would not be tolerated by them. With regard to the education of the pit-boys, he should not be afraid of handing to the great majority of those employed in the North of England any volume of standard English literature, and asking them to read passages from it. After the Hartley Colliery accident a sum more than sufficient to meet the wants of the widows and orphans of the sufferers was accumulated through the generosity of the public, and the surplus was distributed among different coal districts. In the North of England it was determined to make the sum apportioned there the nucleus of a benefit society, which now numbered 11,000 members, and had a sum of 10,000*l.* already invested in Consols. That benefit society was now relieving 136 poor widows, 176 children, and a certain number of disabled men. He was convinced it would be of great advantage if this example were followed in other coal districts. It was stated at a request by a Government Inspector that the great majority of the accidents in mines might be attributed to excess in drinking on the part of the men. Now, he believed that, on the whole, the pitmen might be considered not a drinking set, but facilities afforded under the state of the law led to drinking on pay-nights and on the following Sundays and Mondays. By the acceptance of amendments in Committee he hoped that this fresh attempt at legislation on the subject would have all that fruition that every member of the House must heartily desire.

Mr. LIDDELL rejoiced to find that there was no intention to offer opposition to the Bill at this stage, because he had never before seen such a disposition on the part of both masters and men to discuss this question in a calm and conciliatory spirit, and he hoped that hon. members would approach the details of the measure in a similar spirit. He further hoped that the House would not attempt in any way to remove the responsibility from off the right shoulders, because over-legislation would either transfer the responsibility to the wrong shoulders, or would make that responsibility itself too heavy to bear. The hon. and learned member for the University of Edinburgh appeared to support a view which occupied the attention of the Committee—that viewers employed in mines should be subject to examination, and, presumably, should hold certificates; but the committee declined to make a recommendation to that effect because they thought, and he still thought, it wiser that the responsibility for the election of their servants should rest upon the owners and managers of mines. In the first place, there was very great difficulty in obtaining a competent body of examiners. Then the change would require a revolution in the office of the Privy Council, because it made grants only on examination in elementary subjects. He had always thought that if you could give a child a good sound elementary education, technical education would follow almost as a matter of course, and, therefore, he did not attach the same importance that some did to a special technical education for the benefit of the children of the working classes of this country. There was a principle involved in clause 18, which required that an adequate amount of ventilation should be constantly produced in every mine. Whether just or unjust, that clause as it was worded had produced something like a panic in the minds of mine owners. It was a maxim that the law held a man to be innocent until he was proved to be guilty, but the clause would hold a man to be guilty until he proved himself to be innocent. There was a precedent for this sort of legislation in the Habitual Criminals Act of last year, but he trusted the right hon. gentleman did not wish to treat mine owners as suspected persons, and would be disposed to modify the clause in Committee. As he believed the right hon. gentleman was prepared to give ample time—something like a month—for the consideration of the Bill before the House went into Committee upon it, and as he trusted the right hon. gentleman would not object to some discussion of the principles of the Bill on the motion to go into Committee [Mr. Bruce assented], he would postpone further remarks.

Mr. LANCASTER, who said he represented a population largely engaged in mining enterprise, and had been himself for 30 years engaged in mining operations, thought the real source of danger had been overlooked. The coalowners laboured under disadvantages similar to those of the Irish tenants, for there were certain covenants and conditions they were bound to accept. Coal fields being of limited extent, there was competition to secure collieries, and those who worked them were obliged to accept such covenants as the landowners imposed. This led to artificial boundaries and goafs, and conditions that a certain portion of coal should be paid for in one year whether it were worked or not; and the consequence was that collieries were worked in an unsclenific manner. This was a serious disadvantage, arising from the ownership of the property. We had admitted the right of inspection, and we could not stop where we were; we should be compelled to carry out inspection more efficiently! He had enquired into the modes of working and inspecting mines in Belgium, Prussia, and France; he must say that the system of inspection adopted in those countries was very much more efficient than that of this country; and the reason was that coal fields were leased with a view to their being scientifically worked from the first. Until the same plan were adopted in this country you would not have



efficient inspection. Inspection should begin when the colliery was opened. Under the Code Napoléon the mines were taken possession of by the State, the owners receiving a fair royalty upon the working; and some such course should be adopted here, though, of course, the owners should not be deprived of their property. He could give the working by separate sets of leases upon the same ground. In districts where the land was in small divisions there were generally more accidents than in other places, such as falls of roof, floodings, and so forth. While many of the managers of mines were men of first-class education, and also of great practical experience, it was necessary that the younger men should receive a technical as well as a practical training. He hoped that as to some of these questions the Home Secretary would take a bolder course than that adopted in the Bill.

Mr. GEORGE ELLIOT, having mixed with thousands of working men, with whom he generally had good relations, thought he was correctly representing their views as to the safe working of mines when he said that the attempt to put the whole mines in the country under such an inspection as that which had been indicated would be simply impracticable. (Hear.) Moreover, he believed that a system of that kind would be attended with much less security than the present system. The best guarantee against accidents was afforded not by Acts of Parliament, but by the pecuniary interests and the lives which were at stake. He was clearly of opinion that the present mode of inspection was better than the minute and frequent inspection which was proposed. The existing system might, however, still be improved. For example, he thought there should be an increase, though not a large one, in the number of Inspectors, and that weekly or fortnightly reports should be made to them, setting forth the additions made in the working of the mines, the number of air passages, and other statistics of this description. These returns would be made to the Inspectors of the several districts, whose business it would be to see that the collieries did not retrograde with respect to the security provided against accidents, and who, comparing the condition of one colliery with another by means of these statistics, might stimulate the collieries by the example of such as were better managed. (Hear, hear.) As to the education of managers, he had appointed hundreds of them, and the House would scarcely credit how difficult it was to find the right men who really understood their business. The management of a dangerous colliery was not an easy duty. It was a disagreeable, uncomfortable duty, attended with great labour; and though he did not wish to disparage education in its primary or more technical form, his experience was that a man who had worked in the pit from early days, and who combined with practical knowledge such education as he had picked up by his own study, was more trustworthy than a more scientific but less practical person. (Hear, hear.) He believed the country was fortunate in the class of Inspectors it had at present, that they had been chosen with great care, and that they did their work well. With respect to the hours of labour, there was great difference of opinion on that subject throughout the country. His suggestion with regard to boys was that they should work three or four days a week, but these should be full days—(hear, hear)—and they might go to school for the remainder of the time. For the last 18 months there had been more bitterness, vexation, and loss than he could describe about the man who weighed the coal, and all owing to the simple circumstance that he was paid by the men. He had occasion in one of his collieries to discharge one of these men; there was a strike in consequence for some six months, and he would venture to say that a loss of not less than 10,000*l.*, or 12,000*l.*, altogether was the result. He would suggest that it would be better to have an appeal to a magistrate to get rid of disputes of that kind. It was a most anxious duty to get the instructions with regard to the safety-lamp attended to. What they should endeavour to do was to impress a sense of responsibility on persons, to make the persons who managed feel it, and to get the workmen themselves to do so. He could not understand how it was that men should sympathise with a person who was guilty of an act which endangered their lives. Another point was that viewers and managers were not allowed to work a pit as they wished. In a part of the country with which he was acquainted two men, or a man and a boy, were accustomed to work in a place 12 yards wide; they would not work in a less space. The consequence was that three times the quantity of timber was required, and three times the extent of roads had to be kept open, while three times as much gas was generated than would otherwise be the case. He believed he was speaking within bounds when he said that the cost of coals in working the mine to which he alluded was not less than 15,000*l.* per annum more than it would be in a part of the kingdom where the colliery was worked on a different system. The viewer and manager had to deal with the prejudices and passions of people, and, therefore, needed all the support that could be given them. With all the difficulties that a manager had to contend with, he was to be made liable to punishment if anything went wrong. If there was danger in a colliery, and the manager had not removed it when his attention was called to the matter, he was to be liable to imprisonment under the Bill. Surely that was a point which would require modification. There was no reason in imprisoning a manager or owner for some unavoidable consequences. There was one particular head under which a very large number of accidents happened, and that was the falling of the roof upon the workmen. That was a point to which he wished particularly to call the attention of the right hon. gentleman. Under the system which prevailed at present in many parts of the country the collier placed his own timber, and was the judge of its sufficiency. But if there were safe persons who should be trusted with that particular kind of duty, he believed that a greater saving of life would be effected by a provision of that kind than by any other. (Hear, hear.)

Sir G. GREY said he had listened with attention to this discussion, which had been very interesting, and he thought he might congratulate his right hon. friend the Home Secretary on the manner in which the second reading of the Bill had been received. The subject matter was one in which that large portion of the people of this country who were engaged in mining operations had the deepest interest, and as representing a large colliery population, both owners and workmen, he undertook to say that when the Bill went into Committee there would be no antagonism between the two classes, but that all would be actuated by a desire to adopt such improvements in the law as would tend to prevent those accidents, which were so much to be lamented. (Hear, hear.) He was very glad that his right hon. friend had introduced the Bill at so early a period of the session, and thought it was quite right that it should stand over for a short time in order that its provisions might be thoroughly examined and understood, yet he hoped the Committee would not be postponed to such a late period as to risk that full discussion to which the measure was so justly entitled, for it was in Committee that the main discussion must be carried on, and that they must consider the amendments which might be usefully made. He quite agreed with an hon. gentleman opposite in thinking there was no reason why the Inspectors of mines should be positively limited to the present number. The number was not fixed by law. It was in the power of the Government, acting upon the knowledge they obtained from time to time, to propose to Parliament an increase in the number of Inspectors, and Parliament might sanction that increase by voting the salaries of the additional Inspectors. But it was the greatest possible mistake to suppose that they could have a system of inspection with an army of Inspectors by whom every pit in the country was to be carefully inspected either once in three months or in six. If they were to attempt that they would be adopting the principle recommended by an hon. friend near him, which he did not think they were likely to adopt—namely, that of taking into the hands of the Government the control over the working of mines. He did not admit that because the number of Inspectors was limited therefore their designation should be altered, and they should be called Inspectors to enquire into accidents occurring in mines. That would be an unwise restriction of their functions. In many instances which had come under his experience the Inspectors had been invited to visit particular districts because there was reason to suppose a dangerous system of working was carried on in them, and the Inspectors had frequently gone to examine the pits in order to give those directions and cautions which were necessary to prevent casualties. He entirely agreed with the hon. member for the University of Edinburgh in the opinion that the great security against the frequency of accidents lay in the improved intelligence

and prudence of the workpeople. However plausible in theory the proposal for an examination of all viewers and managers of mines might be, there were great difficulties in adopting that suggestion; but there was nothing to hinder their doing all in their power to improve the education of the miners. He regretted, indeed, that this Bill, which contained so many valuable amendments in the law, did not directly touch the education of the miners. His right hon. friend said the certificate that a child had been able to read and write was often really worthless, and it was very probable that the certificate as hitherto required actually was so. While the schools did not sufficiently cover the country it was impossible to expect parents to send their children to school, and, therefore, they could not obtain such certificates from a certificated master as reliance could be placed upon. But he looked forward to the time when the Bill brought in the other night by the Vice-President of the Committee of Education would come into operation. (Hear, hear.) He did not see, therefore, why they should abolish the certificate required from the child. It would be an improvement if the age below which a boy could not be employed underground were raised to 12 years. A boy might be employed aboveground, and might afterwards come to work underground at the age of 12 just as ignorant as he was at 10. He would suggest whether they might not provide that where there was a school with a certificated master within a certain distance of the pit a certificate from the child should be required. The effect of that would be very beneficial, and when the Bill of the Vice-President of the Education Board, which he trusted would receive the sanction of the House in all its main provisions, came into force, and the schools covered the country, the system would be self-acting—they need not come to Parliament again; and whenever a school was brought within a reasonable distance from the pit, there the certificate might be required. He hoped soon to see a great improvement in the education and intelligence of the miners, which they knew was rapidly advancing; for they would thus obtain what he believed was the only real security against the great loss of life in that branch of industry. (Hear, hear.)

Mr. GREENE, having myself brought that subject before the House some two years ago, must express his satisfaction that the Home Secretary had now undertaken to legislate upon it. There were many valuable points in the measure before them. One important question related to the inspection of mines, and on investigation he found that the miners felt strongly on that matter. At the inquest on the Ferndale accident the jury recommended that the inspection should be made once in three months. He would not presume to say precisely how often it should be made, because an injudicious interference with mining operations was to be deprecated; but, at the same time, if there was to be inspection it ought to be efficient. He thought the law ought also to require that there should be two shafts in mines; for the security of the workpeople must greatly depend on the arrangements for ventilation. Too much reliance had been placed on the safety-lamp, which sometimes proved to be a delusion and a snare, especially when the condition of the mine was not well looked into.

Mr. RODEN, as one who was personally connected with the colliery interest, entirely disclaimed any want of sympathy with the working miners, or any unwillingness to meet their representatives on that important subject. He agreed with the hon. member for Northumberland that one clause in that Bill went far to alter the basis of legislation in this country. Under that clause a man was not, according to the old law, to be held innocent until he was proved guilty, but must prove himself innocent in order to be accounted so. When the Home Secretary came to reconsider the effect of that clause he would scarcely insist upon its retention. Under its operation, whenever an accident occurred in a mine its manager, in a majority of cases, would at once leave the country; or, if it were otherwise, they would have an inferior class of men managing mines, who would take the situation with the risk. It was often assumed that coalowners did not do their duty by the workpeople; but there were fewer accidents in mines, taking everything into consideration, than in most occupations in the kingdom. The clause to which he had referred was drawn so widely that by it the owner and everyone engaged in a mine were made liable to three months' imprisonment. There were members of that and the other House of Parliament who might be innocently placed in that position. It would be highly unconstitutional to interfere with property in this country. At one time minerals, in theory at least, belonged to the Crown, and more accidents happened from mines being laid out in an improper manner than from any other cause. It would be no hardship to the owners of mines to make their property more profitable, which would be the case if mines were laid out properly. Technical education had been ably referred to in that debate, and certainly the greater amount of education that was given the better. At the same time he could not admit that the viewers and managers of collieries were as ignorant and as incompetent as some persons imagined. Speaking for the owners of mines, he was sure they would be only too glad to employ the best educated men they could get hold of. The mine owners were interested in employing as managers the best persons they could get; and the amount which they paid their managers was four or five times as great as that which the Government paid their Inspectors. If there was to be Government inspection at all, it ought to be perfect, and the responsibility ought to go with it. He objected to a half-and-half measure, which would confer the power of inspection on the Government, and attach all the responsibility to the owners.

Mr. VIVIAN, as the representative of a large mining district, and as a person deeply interested in coal mines, felt unfeigned pleasure at the introduction of this Bill at so early a period of the session, and also at the character of the Bill itself. As to inspection, it was difficult to draw the line. If the Government undertook a very close system of inspection it must also undertake a large portion of the responsibility involved in the working of a mine. Every mine owner would hail with satisfaction the prospect of being relieved of that responsibility. It was so weighty a responsibility that he believed if any man, before he became engaged in mines, knew what it was he would scarcely embark in the working of a mine. The dreadful feeling which came over a mine owner's mind when an accident occurred in his mine was what no words could describe. He believed that, as a rule, mines were not better conducted now than they had been before they were first inspected, but very badly conducted mines had almost ceased to exist since that time. He was glad it was proposed to increase the number of Inspectors; and he thought that, when an Inspector suggested anything within the bounds of reason to increase the safety of the mine it was incumbent on the owner to adopt it. The Inspectors were a very useful body of public servants, and he believed they were not sufficiently remunerated. He had heard that the accounts of some of the best Inspectors had been dealt with in a manner that was scarcely fair towards those gentlemen. An Inspector of mines was a man who required special qualifications. He was called on constantly to risk his life, and great consideration ought to be shown in his regard. (Hear.) With respect to the high education of foremen, and such persons in mines, he agreed in the remarks of his hon. friend the member for North Durham. He by no means wished to deprecate education, but from his own experience as a mine owner he knew it often happened that your over-educated man wanted practical knowledge. He thought that upon the mine owner should be thrown the responsibility of keeping proper men to carry on his works. As regarded the miner himself, he could see nothing but good arising from education. Strong prejudices existed in the minds of uneducated miners. The surest way of rooting out those prejudices was by means of education. But he did not quite concur in some of the remarks of his right hon. friend the member for Morpeth (Sir G. Grey). He hardly thought it was desirable that exceptional legislation should be imposed on any particular branch of trade. If his right hon. friend were to propose that before a child was employed in any branch of trade he must produce a certificate, he would go with him on that proposition; but such a condition applied to one trade only would be unjust, because it would have the effect of unduly withdrawing children from the trade. (Hear.)

Mr. KINNAIRD congratulated the Home Secretary on the result of the debate, which would be almost as useful as the Bill itself, from the conciliatory temper in which it had been discussed.

Mr. AKROYD said that when a Bill identical with the present was introduced last year, he presented a petition against it from the owners of three seam mines in his district. They complained that mines of

that kind in the factory districts would be placed at a disadvantage compared with other branches of industry in which children were also employed. The parents sent off their children at eight years of age to the factories, where they remained until they were 13, and were then indisposed to follow the less attractive form of industry in mines. The effect of declaring that no children under 12 should be allowed to work in mines would be that the children would be driven away from the collieries, and the result would be a rise of price in an article of the first necessity. It did not appear that the Committee had made this recommendation from considerations of humanity, because in their report they stated that the employment given to boys was not usually of a laborious character. He thought the difficulty of combining their employment in mines with their education would be met, as he suggested last year, by allowing boys of from 10 to 12 to work on alternate days. At present the colliery proprietors in question found that the educational clauses had so far restricted the employment of boys from 10 to 12 that it was not worth their while to employ them. The Bill contained a great inconsistency, because it applied the provisions of the Workshops Regulation Act to all the young persons employed at the pit's mouth, while those employed underground escaped. At present, undoubtedly, the colliery population in his neighbourhood were the least intelligent portion of the people, and this arose from the inefficiency of the educational provision for them. One great difficulty with which the colliery proprietors themselves had to contend was the ignorance of their workpeople, which rendered it impossible to reason with them upon the laws of supply and demand regulating the rate of wages. The colliery proprietors in his neighbourhood wished the Act to remain as it was at present in respect to children, but here he differed with them. The Low Moor Iron Company agreed with him in preferring the plan of working the boys on alternate days. Recent legislation had all run in one groove—the extension of the Factories and Workshops Act to children employed in different branches of industry; and he could not understand why the Home Secretary should introduce an exemption and variation in the case of those who worked underground. He trusted that the right hon. gentleman would reconsider those points when the House went into Committee.

Mr. BROWN regarded the introduction of the present Bill by the right hon. gentleman with the greatest satisfaction, but he should regret the House agreeing to any provision enabling children under 10 years of age to be worked in mines under any conditions. Upon the subject of the payment of wages, he must express his strong objection to a system which left the men continually in debt, degradation, and misery. (Hear.)

Mr. BRUCE had listened with very great attention to the debate, which was of a very instructive character, and which he was sure would greatly facilitate the labours of the House in Committee. In reply to the suggestion of the hon. member for Northumberland, he might state that he had no objection, on behalf of the Government, to a discussion on the subject on going into Committee on the Bill. He could well understand the anxiety of hon. members to consult their constituents upon a question affecting so deeply the interests of the mining districts, and under these circumstances he should propose to appoint the next stage of the Bill for March 18. (Hear.)

The Bill was then read a second time.

#### FOREIGN MINING AND METALLURGY.

The forgemasters of the Moselle, the Meurthe, and the Ardennes have held a meeting at Metz, with a view to the establishment of a committee, which is to meet once a month, and establish an organ, or a journal. In the second place, the forgemasters of these groups have solicited from the Minister of Commerce a modification of the decree of Jan. 9 on warrants. The modification consists in the rendering identical the *regime* applied both to iron and pig. The Gorcy Works, in the Moselle, have concluded a contract for 500 tons of turn-table plates, at 12*l.* 4*s.* to 12*l.* 8*s.* per ton. Affairs have scarcely resumed a regular current upon the Paris market; quotations are, nevertheless, pretty well sustained. The Alforville rolling-mill, in the Seine, constructed recently, has been brought into operation by its proprietor (M. Mazeline). The total imports of pig and castings into France in the first eleven months of last year were as follows:—

Imported duty free .....	Tons 129,330 .....	1868.	87,359
Imported for shipbuilding .....	3,289 .....	1,322	
Imported with duty paid .....	3,263 .....	16,358	
Total .....	135,882 .....	105,039	

As regards imports of iron and plates, the totals stand thus:—

Imported duty free .....	Tons 66,045 .....	1868.	44,433
Imported for shipbuilding .....	9,364 .....	11,364	
Imported with duty paid .....	2,796 .....	1,729	
Total .....	68,205 .....	57,526	

The quantity of iron minerals imported into France in the first eleven months of 1868 and 1869 were as follows:—

Source of supply .....	Tons 123,081 .....	1868.	89,496
Belgium .....	89,434 .....	84,677	
German Association .....	92,719 .....	66,419	
Spain .....	62,057 .....	75,239	
Kingdom of Italy .....	296 .....	3,479	
Switzerland .....	201,377 .....	195,992	
Algeria .....	2,099 .....	1,365	
Other countries .....	562,054 .....	516,561	

It will be seen that the imports increased last year to the extent of 8 per cent., as compared with 1868, the augmentation occurring principally in Belgian and Spanish minerals. The imports of Moka-el-Hadid magnetic iron minerals into France are destined to acquire shortly a further increase; thus the annual order for these minerals for the Creuzot works alone has just been carried to 100,000 tons.

The advices which have come to hand of late from the Haute-Marne have been satisfactory, the iron trade of that district having decidedly revived. The best descriptions of iron, which were dull six weeks since, are now in a more favourable position, in consequence of the orders which certain works have received. Coke-made iron remains a little neglected. Machine iron is well supported. The metallurgical interest of the department of the Nord is enjoying considerable prosperity at present, both the forges and the foundries being amply provided with orders. The forgemasters of the Nord have formed various opinions with reference to the operation of the decree of Jan. 9, 1870, on warrants; the general feeling appears, however, to be unfavourable to the decree. MM. Pigé and Co. intend to establish a new rolling-mill at Maubeuge. It was stated recently that MM. Jouffroy had transferred an order for iron pipes to be supplied to the French Administration of Telegraphic Lines to the Royal Eagle Tube Works, Birmingham; this appears to have been an error, the order having been transferred to the Imperial Tube Company.

Contracts are about to be let for the erection of a great bridge proposed to be thrown over the old Meuse, near Dordrecht; a contract for the ironwork will be let at the same time. The blast-furnace and coke furnaces of Rossignol, near Walcourt, will, it is understood, be re-lighted May 1. A contract for 10,000 tons of rails required for the construction of a line from Sedan to Lerouville, has been carried off by the great French house of De Wendel. There is nothing very novel to note in the general state of Belgian metallurgy. The administration of the Belgian State Railways let contracts for the supply in two lots of eight passenger locomotives without tenders, the competition being limited to the locomotive builders of Belgium itself. Three Belgian establishments responded to the appeal made to them. MM. Carls, engine-builders at Gand, offered to supply one lot of four engines at 791*l.*; the Haine St. Pierre Company a similar lot at 848*l.*; the John Cockerill Company a similar lot at 872*l.*; and a second similar lot at 884*l.* There was thus a difference of more than 10 per cent. between the highest and the lowest tender. The Tubize establishment did not take part in the adjudication; the concern has belonged for some years to the Belgian General Railway Working Company, and it is sufficiently employed with the work of that undertaking. The Belgian Railway Plant Company, the St. Leonard Company of Liège, and the Ouliet Company, having their locomotive production fully engaged on Russian account until the end of February, 1871, were also prevented from competing at the adjudication; the directors of the three concerns addressed a collective letter to the Minister of Public Works to explain the cause of their abstention. The terms upon which the contracts were let appear rather high, and it is clear that if the State had given out the contracts two years since, when Belgian metallurgical industry was in a depressed and suffering state, it would have obtained the plant of which it stood in need at a much cheaper rate than that at which it will now secure it.

Under the influence of the severe cold which has prevailed of late, great activity has been displayed in the coal workings of the Nord, the Loire, and the Pas-de-Calais; every coal worker has done his utmost to meet the pressing requirements of the moment, but the wants of the trade have been supplied with some difficulty. Coal is comparatively scarce in the producing basins, and the extraction being pushed to its utmost limits is engaged beforehand for a rather considerable period. Prices under these circumstances are, of course, maintained with much firmness; there are still complaints as to a want of trucks upon the French lines. The Paris coal market has also displayed much animation;



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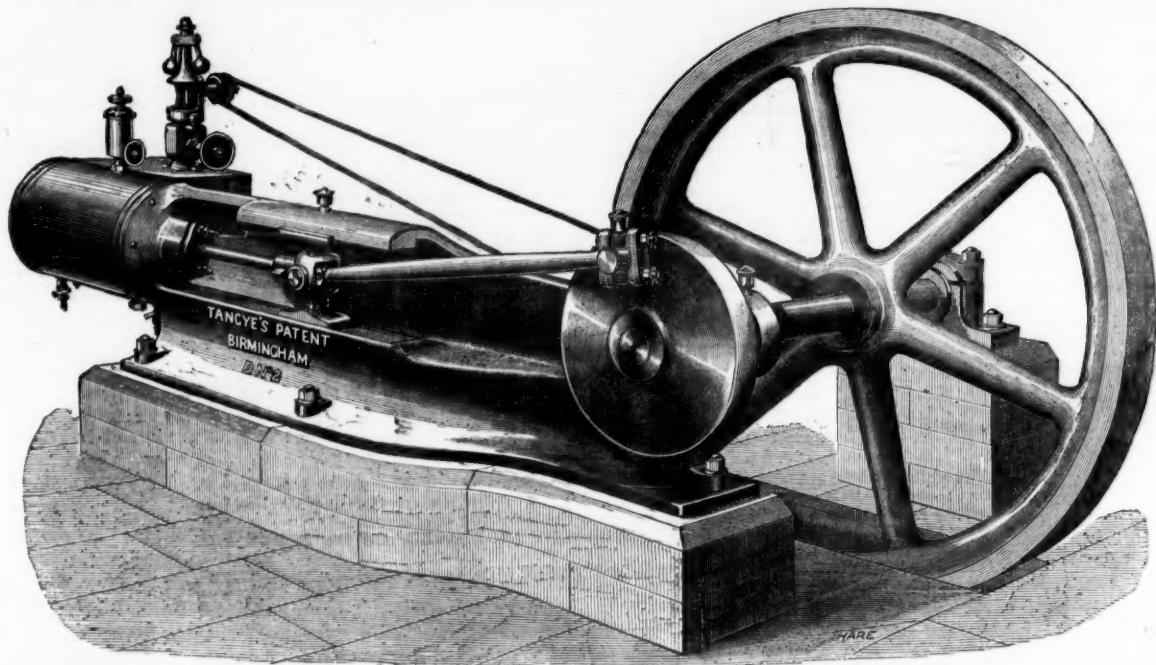
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Price of Engine, with Governor and Feed Pump .....	£20	£27 10	£35	£40	£60	£80	£100	£120
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Diameter of Steam Cylinders, in inches .....	3	4	5	6	8	9	10	12
Length of Stroke, in inches .....	6	8	10	12	16	18	20	24

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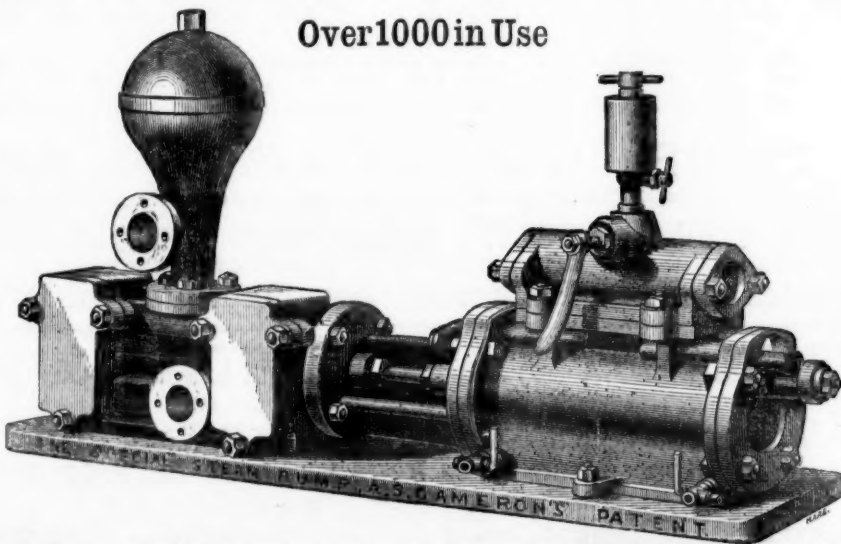
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Diameter of Water Cylinder .....	1½	1½	2	4	3	4	6	5	6	7	4	6	7	8	6	7	8	10	12	7	10
Length of Stroke .....	6	9	9	9	12	12	12	12	12	12	12	12	12	12	12	12	18	24	24	24	24
Strokes per minute .....	100	100	75	60	50	50	50	50	50	50	50	50	50	50	50	50	35	—	—	—	—
Gallons per hour .....	310	680	910	2900	1830	3250	7330	5070	7330	9750	3250	7330	9500	13,000	7330	9500	13,000	—	—	—	—
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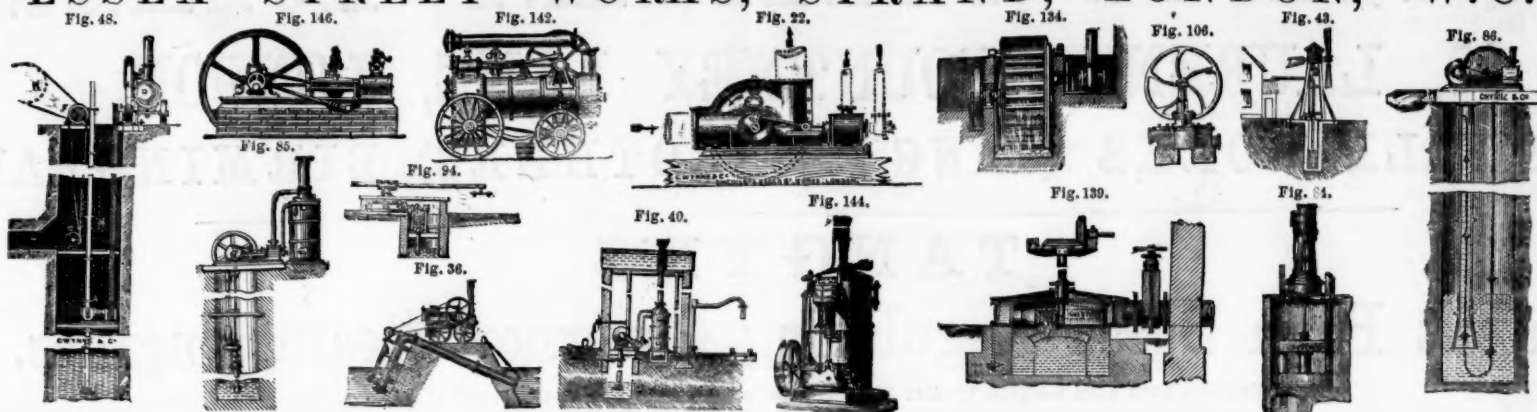


Fig. 144.—Vertical Engine, all sizes, from 2 to 20-horse power.  
Fig. 146.—Horizontal Engine, from 4 to 100-horse power.  
Fig. 142.—Portable Engine, from 2½ to 30-horse power.  
Fig. 40.—Gwynne and Co.'s Combined Stationary Pumping Engine.  
Fig. 139.—Turbine Water-wheel, from 1 to 300-horse power.

Fig. 22.—Combined Pumping Engine, all sizes, obtained Prize Medal, Paris Exhibition.  
Fig. 85.—Deep Well Pumping Engine, all sizes.  
Fig. 134.—Water-wheel Pumping Machinery.  
Fig. 36.—Gwynne and Co.'s Patent Syphon Drainage Machinery.  
Fig. 95.—Horse-power Pumping Machinery.

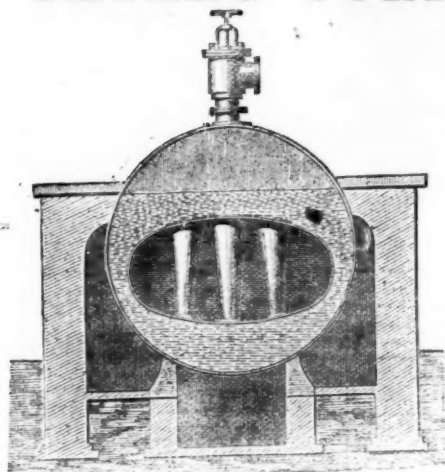
Fig. 86.—Chain Pump Pumping Engine.  
Fig. 48.—Deep Mine Centrifugal Pumping Machinery.  
Fig. 84.—Double-acting Vertical Pumping Engine.  
Fig. 106.—Gwynne and Co.'s Improved Plunger Hand Pump.  
Fig. 43.—Wind Power Pumping Machinery.

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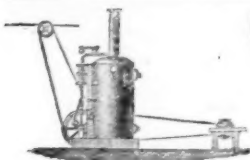
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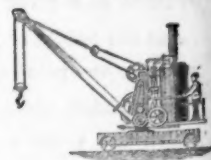
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